Saskatoon Research Station

1917-1985

Agriculture Canada

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cover photo

Scenes from the days of the Dominion Laboratories of Plant Pathology, Forage Crops, and Entomology.

From top to bottom:
Early plant disease survey, 1925.
Threshing crested wheatgrass, 1940.
An Entomology Field Day, 1939.

Saskatoon Research Station 1917-1985

Howard Harding
Editor

Research Branch
Agriculture Canada

Historical Series No. 20
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Acknowledgments

This history represents a truly joint effort by many people. Major contributions were prepared by W.J. White (Forage Crops), R.J. Ledingham (Plant Pathology), and L.G. Putnam, R.H. Burrage, M.E. Taylor, and P.W. Riegert (Entomology). The Editorial Committee also had the benefit of contributions from M.W. Cormack, T.M. Stevenson, J.E.R. Greenshields, J.L. Bolton and C.G. Riley. The assistance of L. Burgess in the final editing process is gratefully acknowledged. Many other people contributed in different ways and their help is sincerely appreciated. A special thank you should go to Janice Epp, Sandra Senftner and Angie O'Shea who typed the manuscript. The willing assistance of S.D. Hanson of the University of Saskatchewan Archives and D.K. Hande of the Saskatchewan Archives Board is also appreciated.

The history took a long time to come to fruition and sadly two of its most active supporters, Ross Greenshields and Bob Ledingham, did not live to see it completed. Perhaps it would be fitting to dedicate this book to their memory, and to all those former employees of the Research Station and the Dominion Laboratories.

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FOREWORD

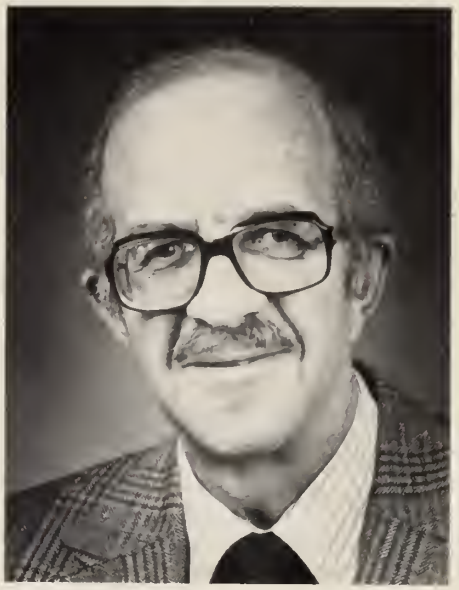
This history of the Saskatoon Research Station was written for the celebration, in 1986, of the 100th anniversary of the establishment of the Experimental Farms Service of the Federal Department of Agriculture. It is written to honor the scientists and their support staff who have done the research that has given Canada one of the most successful agricultural industries in the world. We are proud of these achievements and are pleased to record the role that the Saskatoon establishment has played in this.

Officially, the Research Station as we know it today did not come into being until the late 1950's when the Research Laboratory was ready to be occupied. However, as will be apparent in the history, our roots go back to 1917 when the first federal research officer was hired and located at the University of Saskatchewan to work on the black fly and grasshopper problems facing the settlers. In exchange for use of the University facilities, some teaching responsibilities were undertaken.

Over the years, other problems were recognized and more staff members were added. By 1932, three federal units, the Dominion Entomological Laboratory, Dominion Laboratory of Plant Pathology, and the Dominion Forage Crops Laboratory, were in operation and occupying University space. These units were amalgamated in 1957 when we acquired our own building on the University campus. The benefits of being located on campus have been twofold. Many graduate students, several of whom are now employed by the Research Branch, contributed to our research programs by doing their thesis research in our facilities under the supervision of our staff. Also, cooperative research with the University and with other research organizations on campus, such as the National Research Council of Canada, has been facilitated.

Readers may be disturbed to learn that many of the original problems, such as black flies, grasshoppers and common root rot, are still with us. We trust that this will not be interpreted as a lack of success, since pests can rarely be eliminated. Good control methods have been developed to reduce losses, and much basic information acquired, permitting development of integrated control practices. New demands for better and safer controls are imposed as ecosystems are modified when production practices are changed, and as our concern for environmental quality is heightened. Also the efficiency of our production systems and the quality of our crops must be continually improved if we are to remain competitive with producers in other countries. Thus, to have a healthy agricultural economy the country must continue to invest in research, not only to maintain the gains already achieved, but to bring about further efficiencies in food production. As the Research Branch moves into its second century, we trust that the Saskatoon Research Station will continue to provide high returns on funds invested in agricultural research.

I would like to acknowledge the contribution of all those who provided information for this history. Special thanks are due to Drs. J.F. Doane, R.K. Downey, and B.P. Goplen for contacting former employees and writing their respective sections. Particular credit goes to Dr. H. Harding who volunteered to serve as editor. Also recognized is the photographic expertise of R.E. Underwood.



J.R. Hay
Director

CHAPTER ONE

The Experimental Farms System and Early Agricultural Research in Saskatchewan

On May 22, 1868, the Act for the organization of the Department of Agriculture was passed by Parliament. In that same year the vast area known as the Northwest Territories was acquired by Canada from the Hudson's Bay Company. As the importance of agriculture increased, it became obvious that unlike his European counterparts with the experience of centuries to call upon, the new Canadian farmer had little practical information to help him in his struggle with short seasons, unfamiliar pests, a harsh climate and new soil types.

In 1884 a Select Committee of the House of Commons was appointed to look into the needs of an improved agriculture. An early recommendation was the establishment of an experimental farm. In 1885, William Saunders who, while originally a druggist, had achieved distinction in botany, entomology, horticulture, analytical chemistry and plant breeding, was appointed to investigate further, particularly with reference to the experimental stations recently established in the USA. His report, dated February 20, 1886, recommended that a system of experimental farms, similar to the American model, be set up in Canada. His report was favorably received and on June 2, 1886, a bill entitled "An Act Respecting Experimental Farm Stations" was given Royal Assent.

The Central Experimental Farm, to serve Ontario and Quebec, was located at Ottawa. The branch farms were located at Nappan (Nova Scotia), Brandon (Manitoba), Indian Head (Northwest Territories) and Agassiz (British Columbia). Saunders was appointed Director in October 1886. In 1887 James Fletcher was placed in charge of entomology and botany in the Experimental Farms Branch. Following Fletcher's death in 1908 the work was divided; in 1909 C.G. Hewitt became Dominion Entomologist and H.T. Gussow became Dominion Botanist. In 1914 work in entomology was split off from the Experimental Farms and a new Entomology Branch was created. In 1912, M.O. Malte became the first

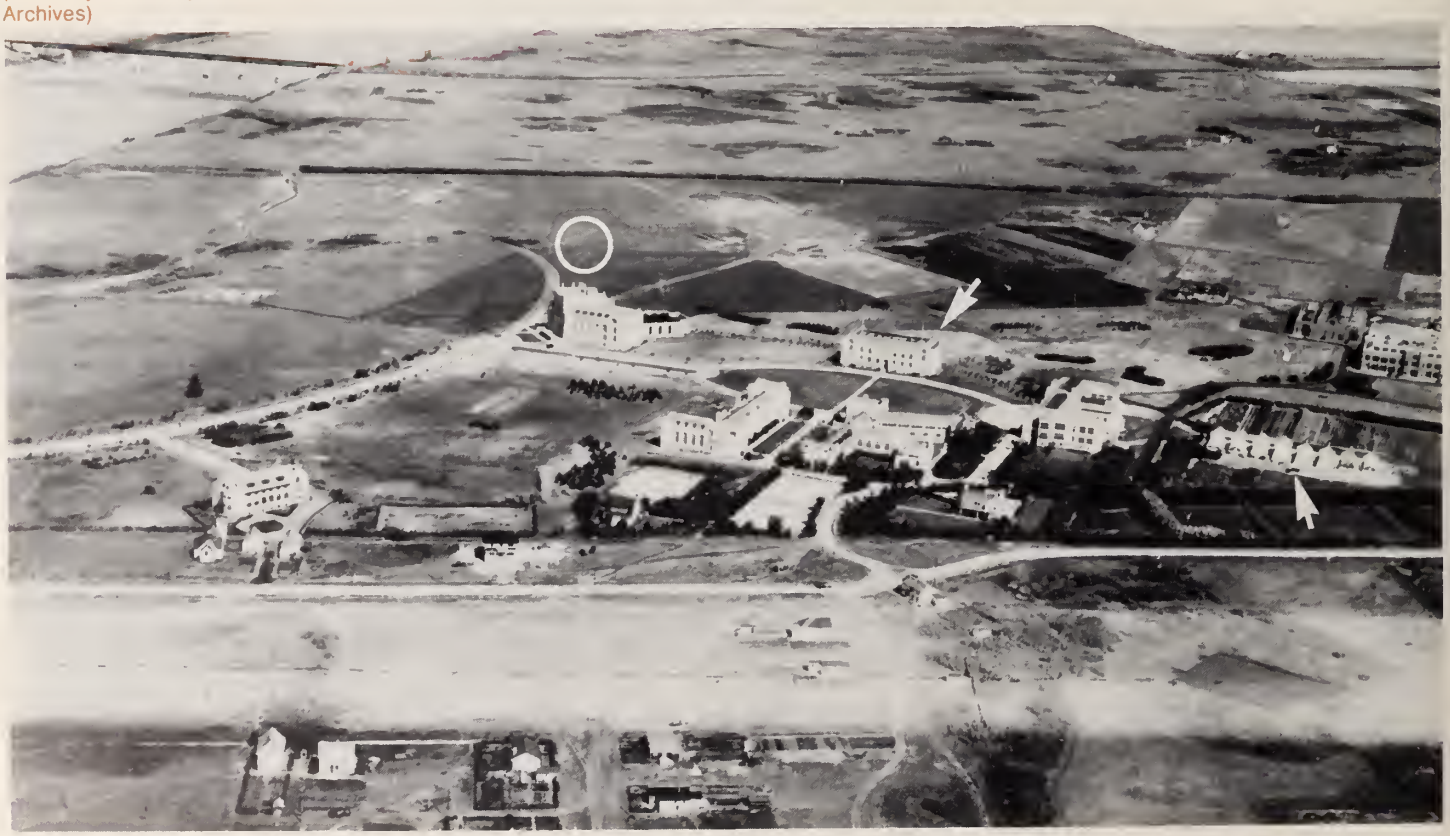
Saskatoon in 1919. The University campus can be seen in the upper left quadrant. Readily identifiable are the present-day Administration Building and Saskatchewan and Qu'Appelle Halls. The Physics and Chemistry Buildings have yet to be built. (Courtesy University of Saskatchewan Archives)

Dominion Agrostologist, in charge of forage crops research across the country.

Between 1900 and 1915 almost half a million new homesteads were filed in Western Canada. Marquis wheat was introduced for trial in 1907 and by 1916 it accounted for nearly 90% of the total acreage grown in Canada. Several new stations were established in Saskatchewan after it became a province in 1905. The original five farms established by the Act were called "farms". The newer ones were called "stations" — a distinction without a difference. Work started at the Rosthern station in 1909, at Scott in 1911, Swift Current in 1920 and Melfort in 1935. A substation at Regina, now the Regina Research Station, opened in 1931. The Dominion Forest Nursery Station at Sutherland started in 1912 as a branch of the Indian Head Forest Nursery Station.

Experimental work at Saskatoon started in 1917 with the establishment of the Dominion Entomological Laboratory. This was located on the campus of the University of Saskatchewan as was the Dominion Laboratory of Plant Pathology, which opened two years later in 1919. The Dominion Forage Crops Laboratory was to be the youngest of the three Dominion Laboratories located on campus, starting in 1931. It was not until 1957 that the present-day Saskatoon Research Station was opened.

The University campus in 1928. The Physics Building, early home of the Dominion Entomological Laboratory, and the horticultural greenhouses, home of the Dominion Laboratory of Plant Pathology 1919-1957, are shown by arrows. The future location of the Research Station is indicated by the circle just north of the Chemistry Building.
(Courtesy University of Saskatchewan Archives)



CHAPTER TWO

The Dominion Entomological Laboratory

Around the turn of the century many areas of Saskatchewan were plagued by biting flies — mosquitoes, horse flies and black flies. They caused serious problems for man and animals alike, particularly in the vicinity of the South Saskatchewan River. As early as 1886, massive outbreaks of black flies killed oxen, cattle and horses near Dundurn. In 1913, over 300 animals were killed just north of Saskatoon and in 1915 there was a large number of fatalities to livestock in the Duck Lake area. Black flies were also a problem in the Qu'Appelle Valley.

At that time there were no professional entomologists in Saskatchewan. In fact there were only two in the Prairie Provinces, one each in Alberta and Manitoba. It was against this background that Alfred E. Cameron was recruited by Dr. C.G. Hewitt, the Dominion Entomologist. The idea of having a resident entomologist working on a typically Saskatchewan problem, i.e. black flies, also appealed to Dr. Walter Murray, President of the University. Accordingly, Cameron was given a dual appointment whereby he would teach courses in entomology and parasitology in addition to his federal responsibilities. Thus, the Dominion Entomological Laboratory was established on the University of Saskatchewan campus in 1917.

Dr. Cameron, who was a Scotsman by birth, came to Saskatoon from British Columbia where he had been fighting insect pests in fruit tree orchards. He was an expert on biting flies and he looked forward to the new challenges in Saskatchewan, particularly the black flies. However, in 1918, grasshoppers appeared in record numbers and this situation continued for the next 5 years. By 1919, Cameron was occupied full-time with a baiting program to control the grasshoppers, leaving him little opportunity to deal with biting flies. It soon became evident that Cameron was not enthusiastic about a life-long career in economic entomology, particularly controlling grasshoppers, and in 1920 he resigned as Officer-in-Charge to take up full-time teaching at the University. With his departure from the Dominion Entomological Laboratory, the federal research on black flies was discontinued and was not resumed until 1947.

In 1921 there were still very few entomologists in Canada and Hewitt was forced to look south of the border, to the U.S. Department of Agriculture Station in Charlottesville, Virginia, for a new Officer-in-Charge. He recruited Kenneth M. King who was born near Virginia City, Montana in 1896. Because King was not a Canadian citizen, a special Order-in-Council had to be passed to allow him to work in Canada. The necessary legalities taken care of, King arrived in Saskatoon in August 1922.

King had few resources to assist him in the battle against prairie field crop pests; a battle to which he was committed for almost a quarter of a century. He inherited Cameron's office-laboratory space in the Physics Building and very little else — a well-used typewriter, a chair, two desk-top trays, one open-sided wastepaper basket, 24 insect specimen boxes (without insects), 12 lamp chimneys, 20 flower pots and a 1920 Model T Ford. He had no office staff and only one seasonal assistant.

Thus armed, King set out to control grasshoppers, wireworms and the redbacked cutworm and related species, including the bertha armyworm. Responsibility for the other two serious insect pests, the pale western cutworm and the wheat stem sawfly, was

A.E. Cameron, Officer-in-Charge of the Dominion Entomological Laboratory, 1917-1920.

The South Saskatchewan River at Saskatoon in 1909, showing the rocky nature of the river bed, which provided breeding grounds for black flies.
(Courtesy Saskatoon Public Library)

assumed by the Dominion Entomological Laboratory at Lethbridge. However, each time either of these pests threatened Saskatchewan crops the Saskatoon staff became heavily involved. This was particularly true with the sawfly, which at one point seemed about to put an end to wheat production in southwestern Saskatchewan.

From the beginning, service to the farming community was a high priority and this meant frequent involvement in extension work, often in close collaboration with the provincial Department of Agriculture and local municipal officials. Interest among farmers was high and extension meetings or field days usually drew a large attendance. On July 10, 1936, 650 people showed up for a field day at the Illustration Station on the Willoughby farm at Parkside, Saskatchewan. At the time, this was the second largest turn-out ever at such an event anywhere in Canada. However, extension was a two-way street. It was a learning process for scientist and farmer alike and it was also a channel to public support. King was later to attribute the growth of his laboratory to this close cooperation with the provincial Department of Agriculture and the farming community.

In 1922, King had just one assistant. He was Norman J. Atkinson who worked almost entirely on the biology of the redbacked cutworm and on other related cutworms. In 1925 Ellis McMillan joined the staff, also to work on cutworms. He was followed by Arni P. Arnason in 1927, and by Robert Glen and Lorne C. Paul in 1928. Arnason and Glen were to work primarily on wireworms while Paul was assigned to grasshopper control. During the "Dirty Thirties" another six staff members were added:- Howard McDonald (1931), cutworms; Harold A. McMahon (1931), wireworms; Virgil L. Berg (1933), grasshoppers; William B. Fox (1934), wireworms; Henry Williamson (1935), grasshoppers; Lloyd G. Putnam (1939), grasshoppers. However, in those days the grasshopper was the number one enemy and all staff members were expected to pitch in with control work whenever there was a serious outbreak.

This rapid increase in staff seems to have owed little to any particular policy of the Entomological Branch. The authorization to increase staff came about almost entirely as a result of the pressure exerted by leading farmers on the Minister of Agriculture. Even King's influence seems merely to have been on the running of the Laboratory and in choosing the best possible people to staff it. However, with the increased number of staff came the inevitable overcrowding. Some time after 1922 the Laboratory moved out of the basement

K.M. King, Officer-in-Charge of the Dominion Entomological Laboratory, 1922-1946.

room in the Physics Building and into the College of Agriculture Building (now Administration). In 1929, they moved to the basement of the newly completed Field Husbandry Building (now Crop Science and Plant Ecology). By 1936 overcrowding had again become so bad that three additional offices had to be rented in the Federal Building in downtown Saskatoon. Finally in 1938 the University extended the Field Husbandry Building and made seven basement rooms available to the Dominion Entomological Laboratory. This was to be "home" for almost 20 years until the present Research Station was completed in 1957.

The Physics Building, University of Saskatchewan, early home of the Dominion Entomological Laboratory (1921). (Courtesy University of Saskatchewan Archives)

The Field Husbandry Building, University of Saskatchewan (1929). This was to be the final University accommodation for the Dominion Entomological Laboratory before it moved into the present Research Station in 1957.

Staff of the Dominion Entomological Laboratory, 1936. Back row (left to right): A.P. Arnason, V.L. Berg, W.B. Fox, H.A. McMahon, H. Williamson, J.W. Boyes. Front row: A.H. Sparrow, R. Glen, H. McDonald, Rose Goorevitch, C.R. Douglas, L.C. Paul, K.M. King.

The grasshopper, scourge of the "dirty thirties".

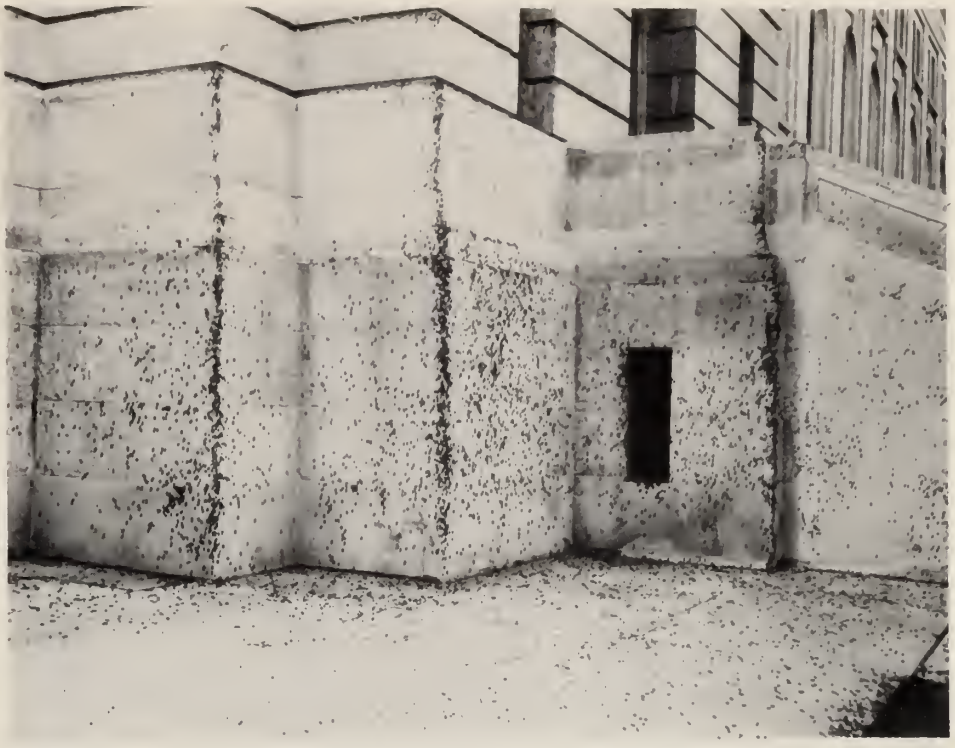
Grasshoppers and dust — these were the bywords of the "dirty thirties" and by 1935 the grasshopper project had become the major function of the Laboratory. The previous four years had witnessed a series of invasions from the south by the immigrant migratory grasshopper, *Melanoplus sanguinipes*, causing widespread destruction of cereal and pasture crops already hard hit by drought. King, Paul, Berg and Williamson worked full-time on grasshoppers but during "crisis" periods all available staff members were pressed into service.

An important early development was the systematic annual survey for both adult grasshoppers and eggs. The surveys were first done in cooperation with the Manitoba pioneer naturalist and entomologist, Norman Criddle, whose name was to be immortalized in "Criddle Mixture", a horse manure grasshopper bait laced with arsenic. However, Criddle died in 1933 and from then on the Saskatoon entomologists had to go it alone, although they did cooperate closely with colleagues in both North Dakota and Montana as it became apparent that their problems were nearly identical.

For a number of years, the data from individual survey observations were compiled in a technical report together with precise directions to each of the sampling sites. This allowed return visits through the season to check on grasshopper development. In later years the format for reporting changed but the annual survey and forecast, with several refinements along the way, culminating in today's computer-generated forecast map, has been maintained virtually without interruption for more than 50 years.

Grasshopper control had been based on poisoned bait, mainly arsenic, almost from the beginning of the century and continued so until the late 1940's. In the early years "Criddle Mixture" was the standard. Later, other ingredients such as sawdust, bran and various fodders replaced horse manure. Cheaper baits became necessary as demand increased — in one year during the late thirties about 1100 carloads of sawdust were used. Experiments were carried out on application methods such as spreading bait at different times of day, using many ingenious home-made spreaders. Did grasshopper control methods pay off? The necessary statistics were gathered by Paul in the 1930's and the answer was clear — for every dollar spent the farmer saved about $17.00 worth of crop.

Soil drifting at Brittania School, southeast of Estevan, May 30, 1935.



Grasshoppers on the Legislative Building just below the Field Crop Commissioner's Office, August 18, 1938. (Courtesy Saskatchewan Government Archives)

Home-made grasshopper catcher in use on the J. Lenon farm at Assiniboia, June 19, 1933.

Bait spreaders came in all shapes and sizes.

A Field Day at White Fox, Saskatchewan, July 15, 1936. R. Glen was the speaker on entomology.

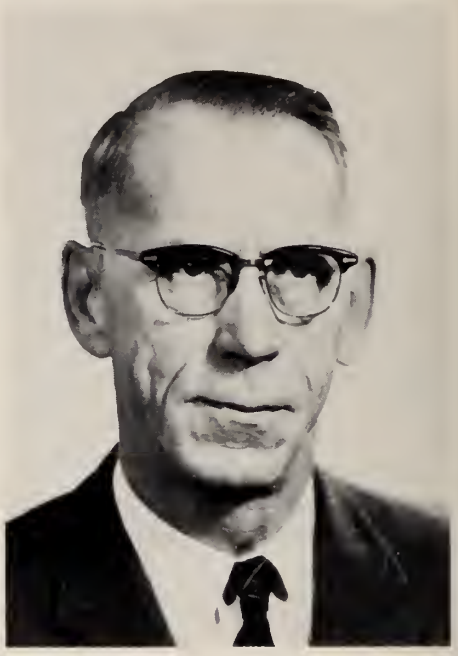
Part of the crowd of over 500 people listening to K.M. King discuss cutworms and wireworms at a Field Day, Beaverlodge, June 10, 1939.

R. Glen (left) and C.W. Farstad in a field of wheat completely destroyed by the wheat stem sawfly (1944). (Courtesy Western Producer Publications)

Next in importance were the wireworms, which by the beginning of the 1930's were a problem in most agricultural soils on the Prairies. They were most destructive following a year of summerfallowing, particularly in medium-textured soils. All field crops were attacked but spring wheat and rye were especially susceptible. At that time the only practical means of wireworm control seemed to be through management practices. Consequently, long-term research programs on the effects of different practices were set up at the Swift Current Experimental Station where a particularly good "wireworm field" had been found.

To obtain the necessary quantitative data wireworms had to be counted, and before they could be counted they had to be separated from the soil by sifting it through a series of sieves. Several thousand hours were spent doing this and many of the Saskatoon entomologists were sent to the Swift Current plots to serve their apprenticeship, although at times it must have seemed like they were serving a life sentence. Sifting soil by hand was a tedious and tiring job at the best of times. With heavy soils in bad weather it was particularly miserable work. The project was supervised and coordinated by Arnason but it fell to Fox and McMahon to do the bulk of the work.

As the sampling, sifting and counting went on it soon became obvious that the project could not be completed successfully without accurate identification of the species involved. There were many different wireworms and unfortunately the systematic study of them, particularly the larval stage which caused the damage, had been largely neglected. As a result there were no useful identification keys available. This was the deficiency that Glen undertook to remedy, ultimately producing keys for the identification of larvae of 96 species of wireworms, culminating in a 250-page monograph published in 1950. These keys were destined to be the standard for several decades.



A.P. Arnason, Officer-in-Charge of the Dominion Entomological Laboratory, 1946-1952.

Modified seeding equipment used in wireworm damage reduction experiments at the Swift Current Experimental Station, 1929.

Wireworms, showing the larval stage and the adult beetle.

In 1938 insect damage in Saskatchewan reached an all-time high but then the pressure eased. There were fewer grasshoppers and wireworms; cutworms were present in very low numbers, and only the sawfly continued to resist the farmers' attempts at control. In 1943 alone, damage was estimated at over $18 million. Then in 1946, Rescue, a solid-stemmed cultivar resistant to the sawfly was released by Swift Current. This and subsequent cultivars to all intents solved the sawfly problem. However, this was to be in the future. In 1939 the international political scene was in a state of turmoil and in September of that year the Second World War broke out.

The next few years saw many disruptions, both to research programs and to personnel. In 1939, Berg joined the Air Force, Williamson and Putnam reported for Army service in 1940 and 1942, respectively, and McMahon joined the Navy in 1943. In 1944, Paul joined the faculty of the University of Saskatchewan and H.W. Moore was transferred from the Brandon Station to take his place. Putnam and McMahon returned from active service in 1944 and 1946, respectively, and in 1945 Glen left for Ottawa to become the Research Coordinator for the Entomology Division. Finally, in 1946, King transferred to Victoria to set up a new entomology laboratory there.

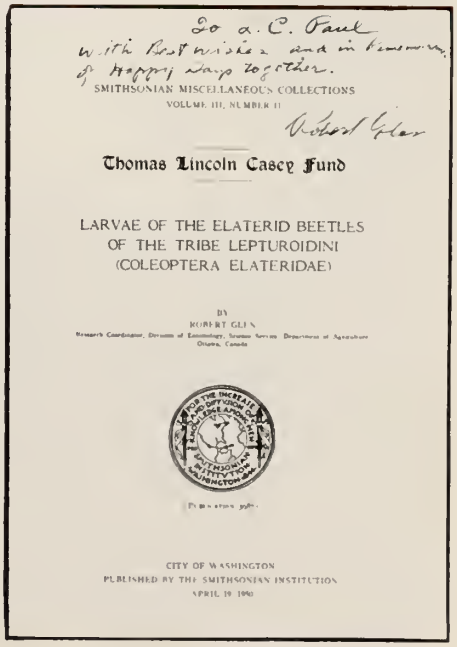
It would be difficult to overestimate King's influence on the Saskatoon laboratory and entomology in general. He had seen the staff grow in numbers from 2 to 20 in somewhat over 20 years. He was probably the first trained "ecologist" in Western Canada and the great importance that he attached to quantitative methods was a radical departure from the attitude of the earlier naturalist-entomologists who were trained mainly in descriptive biology. This influence is still felt today in the integrated pest management approach to insect control. In addition to his academic achievements, he also found time to coach the University of Saskatchewan basketball team, once winning the western inter-collegiate championship with Ellis McMillan as the star forward. Predictably, when he "retired" in 1956 King took up a second career — this time as an ordained Anglican minister.

The personnel changes continued with the end of the war. Many of the new faces had been seasonal assistants who then did graduate work before becoming full-time employees. P.W. Riegert and D.F. Hardwick started in 1944 and R.A. Fuller in 1946. In 1947 no fewer than six new staff members were added — J. Stangeland, R. Pickford, R.Y. Zacharuk, M.E. Taylor, W.W.A. Stewart and F.J.H. Fredeen. These were later followed by J.C. Arrand (1948), C.H. Craig (1949), D.C. Eidt (1950), G.R.F. Davis (1952), R.H. Burrage (1953) and A.B. Ewen (1957). Some of these spent only a short time at Saskatoon but many were to spend all, or a large part of their scientific careers, with the Dominion Entomological Laboratory and subsequently the Saskatoon Research Station.

Paul Riegert worked on grasshoppers for over 20 years before moving to the University of Regina; Roy Pickford and "Bob" Burrage spent almost 30 years on grasshoppers and wireworms, respectively; "Woody" Stewart spent more than 30 years working first on garden insects and then mosquitoes; Maurice Taylor worked on cutworms for

R. Glen, Officer-in-Charge, Dominion Entomological Laboratory 1928-1945; Chief, Entomology Division 1950-1957; Director-General, Research Branch, 1959-1962; Assistant Deputy Minister for Research, 1962-1968.

Frontispiece to Glen's 1950 monograph on wireworms.



To A. C. Paul
with best wishes and in memory
of happy days together.
Robert Glen

SMITHSONIAN MISCELLANEOUS COLLECTIONS
VOLUME III, NUMBER 11

Thomas Lincoln Casey Fund

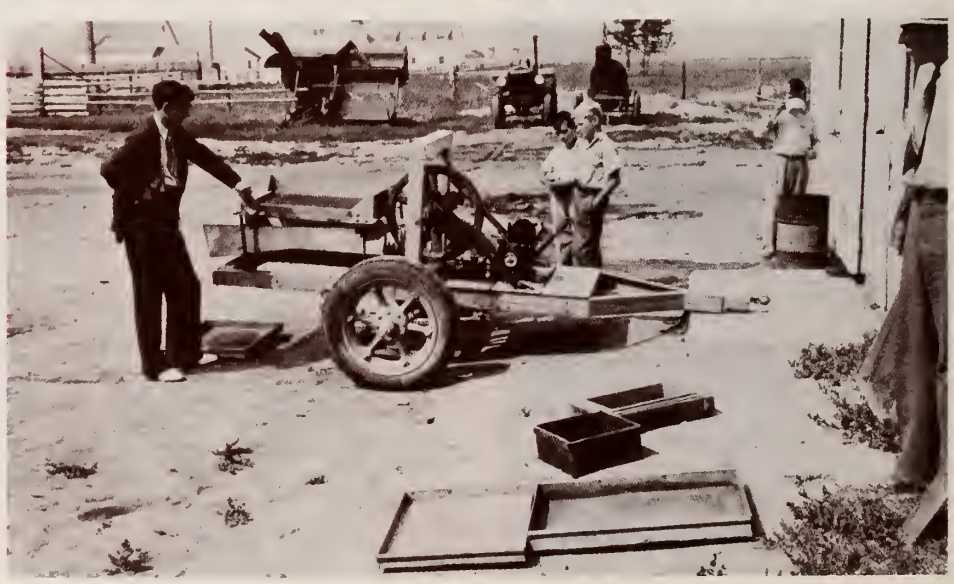
LARVAE OF THE ELATERID BEETLES
OF THE TRIBE LEPTUROIDINI
(COLEOPTERA ELATERIDAE)

BY
ROBERT GLEN

CITY OF WASHINGTON
PUBLISHED BY THE SMITHSONIAN INSTITUTION
APRIL 19 1950

Wireworms "Fallow Methods" project, Swift Current 1932. Field staff and equipment: Left to right R. Glen, A.P. Arnason, H.A. McMahon, H. McDonald.

Reuben Lowe (left) and John Joyce sifting soil to extract wireworm larvae, Swift Current, 1941.



Mechanical soil sifter powered by a gasoline engine, built at Swift Current for the wireworm project. H. Williamson leans on the machine, while H.A. McMahon (at right) smiles with relief, July 28, 1938.

A.R. Brooks, Insect Taxonomist, 1946-1962.

10 years before spending more than 20 years as the Research Station's first Scientific Information Officer; "Dick" Davis did pioneering work on insect nutrition for more than 30 years; Hartley Fredeen was to spend 38 years controlling black flies; Harvey Craig and "Al" Ewen are still active staff members working on forage crop insects and grasshoppers, respectively.

One name not included in the list above is that of A.R. Brooks. A native of Indian Head, "Art" Brooks first worked at the Dominion Entomological Laboratory as a seasonal assistant in 1937. After graduating from the University of Saskatchewan, he was appointed to the Insect Systematics Unit in Ottawa where he became an acknowledged expert on insect identification. However, he never liked Ottawa and tried repeatedly, and unsuccessfully, to persuade his superiors to transfer him to Saskatoon. Then in late 1946 the Chief of the Systematics Unit retired and was not replaced immediately. Brooks lost no time in presenting his case to the Dominion Entomologist and convinced him that such a move would be in the best interests of both the Unit and of the prairie entomologists. With the paperwork conveniently prepared ahead of time and his bags packed and ready to go, Brooks escaped to the West before the new Chief was appointed, much to the latter's dismay. During his years in Saskatoon he set out to identify and catalogue all the Prairie insects, a mammoth task. He published monographs on grasshoppers and wireworms and identified the previously unknown adult stage of a great number of larvae. The insect collection, which was the basis of his identification program, was greatly increased. He collected 25,000 to 30,000 specimens each year! The National Collection accepted about 10,000 of them — each year. Tragically, Brooks died of a heart attack in 1962 at the age of 45.

Before the mid-1940's there were very few insecticides. Arsenic-containing baits were used against grasshoppers and redbacked cutworms with fair success but they took a long time to prepare and they were difficult to apply properly. Wireworms could be controlled by incorporating naphthalene flakes into the soil but this was too costly to be practical. In gardens, some of the common insects were controlled by paris green and the contact poisons such as pyrethrum, derris and nicotine sulfate. But all in all, the entomologists had a poor selection of chemical weapons. All this changed in 1944 with the discovery of DDT.

Initially used to control mosquitoes in

Bait mixer, 1939 model.

the tropics, DDT proved to be a remarkably effective general insecticide. Its success soon led to the development of related compounds such as chlordane, heptachlor, benzene hexachloride (BHC), lindane and gammexane. In 1946, Fox tried gammexane as a seed dressing to control wireworms in wheat. The results were spectacular! At a rate of 70 grams per hectare (1 ounce/acre), wireworm damage was reduced almost to zero. In the next 2 years Putnam showed that gammexane, chlordane, BHC and toxaphene applied as baits, sprays or dusts provided good grasshopper control. Spraying was very successful and, since boom sprayers were by this time in common use on many farms for herbicide application, this became the recommended method for applying insecticides for grasshopper control.

Other insect pests were controlled successfully by the new insecticides — the flax bollworm with DDT dust using a Buffalo turbine duster, and the redbacked cutworm by chlordane baits and dieldrin sprays. Infestations of bertha armyworm on rapeseed in the late 1940's and early 1950's were controlled by air- and ground-based spraying with DDT and endrin. In 1949, McMahon, Arrand and Craig used DDT and related insecticides to control plant bugs in alfalfa seed crops.

Alfalfa seed production had become a major cash crop in northeastern Saskatchewan after the war and this meant that the forage crop entomologists had to spend a fair amount of time on the edge of the

Top:
Early chemical control of insects. A.P. Arnason with "horse and pole" duster applying arsenic to control bertha armyworms in sweetclover. June 25, 1928.

Centre:
In-furrow incorporation of naphthalene flakes to control wireworms. Washington Farm, Swift Current; July 8, 1936.

Bottom:
Spraying the South Saskatchewan River, at Fish Creek, with DDT to control black flies. May 1948.

northern bush. In those days the roads in the White Fox area were little more than trails. On one occasion, Craig and Arrand were delayed by a large black bear ambling along in front of them. Arrand was an ardent hunter and regularly took a shotgun along with him. With a nervous Craig behind the wheel, Arrand jumped out of the car and let the bear have a round of pellets, square in the lower posterior. The bear took off into the bush and shot 30 feet up the nearest poplar tree, crying like a baby. It was only after the tears of laughter dried that the "hunters" thought about what might have happened if the bear had turned around and headed their way.

DDT also beat the black flies. In 1947, exactly 30 years after Cameron's arrival in Saskatoon, work on biting flies was resumed with the appointment of Hartley Fredeen. In June 1944, swarms of black flies, bred in the South Saskatchewan River, had descended on the Saskatoon-Prince Albert area, and between 1944 and 1947 more than 1100 animals had been killed. Fredeen's special task was to test DDT as a black fly larvicide in the South Saskatchewan River. Using an aircraft from the Department of National Defence at Suffield, a 160-km stretch of the river was sprayed in May 1948. The level of control was amazing. The black flies were virtually eradicated with the phenomenally low DDT concentration of 150 parts per billion. Fredeen discovered that when DDT was applied to a turbid river it was adsorbed onto suspended silt particles. This meant that black fly larvae, being filter-feeders, could be selectively poisoned with extremely low doses of the insecticide. This discovery led to even better control methods, not only in the Saskatchewan River Basin but in several African countries also.

However, great as these success stories were, it gradually became apparent that DDT and related pesticides were not the final solution to the insect problems faced by Western Canadian farmers. Evidence was accumulating that they persisted in the soil for an alarmingly long time and they were showing up at places in the food chain far removed from the point of application. In the last few years before the Dominion Entomological Laboratory passed into history it was clear that this first "golden age" of chemical control of insects was coming to an end.

CHAPTER THREE

The Dominion Laboratory of Plant Pathology

W.P. Fraser, first Officer-in-Charge of the Dominion Laboratory of Plant Pathology, 1919-1925.

Organized plant pathology in Saskatchewan began in 1917. In that year W.P. Fraser was commissioned by the Dominion Department of Agriculture to study the rust situation in Western Canada. The stimulus for this was the disastrous stem rust epidemic of 1916, which had caused an estimated loss of about 2.7 million tonnes of wheat. Fraser spent the summers of 1917 and 1918 in the West, based at the newly-constructed field laboratories at Brandon, Manitoba, and Indian Head. In 1919 the Dominion Laboratory of Plant Pathology was established on the campus of the University of Saskatchewan and Fraser was appointed as the first Officer-in-Charge.

Fraser was a native of Nova Scotia and before his move west he was a professor at Macdonald College in Quebec. He was acknowledged as a Canadian expert on rusts and with Margaret Newton, his graduate student at Macdonald College, he recognized in 1918 that there were different strains of stem rust. In 1919 he began a series of annual surveys to determine the distribution of these different "physiologic races" of rust in Western Canada. Then in 1924, a landmark Rust Conference was held in Winnipeg at which the decision was made to set up a Dominion Rust Research Laboratory, located on the University of Manitoba campus in Winnipeg. This meant that all of the rust research being carried out within the Dominion Department of Agriculture would be centered at Winnipeg. When this happened in 1925, Fraser resigned as Officer-in-Charge and became Professor of Biology at the University of Saskatchewan.

Fraser was a born naturalist and was intensely interested in the native flora of the prairies. He collected, identified and catalogued numerous plant species and built up an excellent herbarium. In 1937 he and R.C. Russell, who was a staff member of the Dominion Laboratory of Plant Pathology, published "A List of the Plants of Saskatchewan". Following Fraser's death in 1943, the herbarium was designated "The W.P. Fraser Herbarium" by the University of Saskatchewan, where it is located.

Fraser's first assistant was his former graduate student, Margaret Newton, who started in 1920. However, she stayed for little more than a year before joining the Biology Department in 1921, but up until 1925 she and Fraser continued to cooperate on the identification of races of stem rust. In 1925 she moved to the Dominion Rust Research Laboratory in Winnipeg and continued her work on rusts there until her retirement in 1945.

Fraser's successor as Officer-in-Charge was G.B. Sanford, another Nova Scotia native who had moved to Alberta in 1908. Sanford's main interest was in root diseases and he was one of the first to develop the concept of biological control of plant diseases. However, he was destined to

The 1924 Rust Conference. Left to right W.C. Murray (President of the University of Saskatchwan), W.P. Thompson, H.L. Bolley, D.L. Bailey, H.K. Hayes, H.T. Gussow, R.A. Newton, J.H. Grisdale, W.P. Fraser, W.P. Motherwell (Minister of Agriculture), J.B. Harrington, J.G. Dickson, H.M. Tory, V.W. Jackson, G.R. Bisby, F.L. Greaney, E.C. Stakman, P.M. Simmonds, I.L. Connors, W.R. Leslie, W.T.G. Weiner.

stay only a short time in Saskatoon and in 1928 he became Officer-in-Charge of the newly-opened Dominion Laboratory of Plant Pathology in Edmonton.

The third Officer-in-Charge at the Saskatoon Laboratory was yet another native of Nova Scotia — P.M. Simmonds. His given names were Prye Morton, although it is very doubtful if any of his colleages used them, or even knew them. His colleague in the Biology Department, T.C. Vanterpool, commonly called him "Sim" but to practically everyone else he was "P.M.". He began as an assistant to Fraser in August 1921 and then took study leave at the University of Wisconsin from which institution he obtained a Ph.D. degree in 1928, the same year he became Officer-in-Charge. For the next three decades Simmonds' thinking was to dominate cereal root disease research in Western Canada.

In early cereal disease surveys the widespread occurrence of common root rot caused by *Helminthosporium sativum* (as the fungus was then called) was noted. This disease had been reported first from Iowa in 1910 and it soon became apparent that it was an important limiting factor in cereal production throughout Western Canada and the Northern Great Plains states of the USA. Take-all in wheat was recognized in 1923 although it had been collected once before at the Dominion Experimental Station at Scott. In 1925, a new disease, referred to as "browning" root rot, was found in wheat. This disease was first recognized as a problem in well-farmed crops on the highly productive land north of Indian Head. The widespread occurrence of these serious diseases made it apparent that major root disease research projects should be carried out in Western Canada. Consequently, when the rust investigations were transferred to Winnipeg in 1925, Saskatoon became the main center for cereal root disease studies.

From the beginning, the Plant Pathology Laboratory occupied space in the headerhouse of the Horticulture Building and had one attached greenhouse. Because of space limitations, the Officer-in-Charge and the stenographer had an office in the Field Husbandry Building, an awkward arrangement but one that prevailed until about 1950. For the intervening years, the staff in the headerhouse had to commute to the Field Husbandry Building to take telephone calls. The laboratory and offices were sandwiched between the Horticulture Department on the one hand and the Anatomy Department of the Medical School on the other. Medical students dissected cadavers in the Anatomy greenhouse and towards spring, when the cadavers attained a certain "ripeness", the plant pathology staff carried home with them a quite distinctive odor.

A field laboratory was established at the Indian Head Experimental Farm around 1920. It was a comfortably appointed frame building about 6 x 9 metres with a full basement and a furnace. D.L. Bailey, who was later head of the Dominion Rust Research Laboratory (1925-1928) before moving

G.B. Sanford, Officer-in-Charge of the Dominion Laboratory of Plant Pathology, 1925-1928.

P.M. Simmonds, Officer-in-Charge, Dominion Laboratory of Plant Pathology, 1928-1957; Head, Plant Pathology Section, 1957-1962.

The greenhouses at the University of Saskatchewan, home of the Dominion Laboratory of Plant Pathology (1931).

to supervise the graduate studies of a generation of plant pathologists at the University of Toronto, spent the summers of 1920 and 1921 carrying out surveys from this location, moving to Saskatoon for the winters. In 1922, J.H. Craigie was a temporary assistant; he went on to do pioneering work on wheat rust and later became Dominion Botanist. The Indian Head field laboratory was manned during the summer months more or less continuously until 1942 with Simmonds, B.J. Sallans and R.J. Ledingham serving their "apprenticeships" there.

The initial plant pathology field plot area, about 0.5 hectares in extent, was situated behind the present Education Building on the University of Saskatchewan campus. Wireworms, gophers and sparrows were the main deterrents to the production of a crop. The wireworms were baited with cut potatoes, the gophers were trapped, and the sparrows scared off by a sunrise shift of junior staff. Later experiments were done on the Preston Avenue Field Husbandry plots. Plot work was done also at the Rosthern and Scott Experimental Stations, and, as transportation improved, at such distant locations as Swift Current, Regina and Melfort.

Prior to the mid-thirties there was virtually no equipment designed specifically for field plot work. Plots were seeded by hand in rows made with a garden hoe, and harvested with a sickle. Consequently, randomized, replicated experiments suitable for statistical analysis consumed a vast amount of time and effort. The development and availability of the Kemp V-belt seeder, in the mid-thirties, was a major step forward. Laboratory facilities were adequate, but by today's standards they were quite primitive. In spite of this, major strides were made in the understanding and control of the major root disease problems affecting cereals.

The Plant Pathology Laboratory, Saskatoon (December 1929).

The kind of country in which take-all was a problem on freshly broken land in the 1920's.

Dusting machine used for treating cereal seeds (1923).

The components needed to build a "Wisconsin temperature tank" for studying root diseases under controlled temperature. (Photograph sent by P.M. Simmonds from the University of Wisconsin to W.P. Fraser, January 9, 1925).

The study of "take-all" of wheat was started by R.C. Russell when he joined the staff in 1924, soon after the disease was found in Saskatchewan. The worst affected areas were in the parkland zones of northern and eastern Saskatchewan, particularly where freshly broken land had been seeded to wheat for several years in succession. Losses in individual fields were as high as 40%. However, Russell's studies showed that the control of take-all was relatively easy. One year's summerfallow effectively broke the disease cycle. The inclusion of oats, flax or another resistant crop in the rotation was also very effective. As the period of active land breaking came to an end, take-all became a "minor" disease although it still causes problems occasionally.

The term "common root rot" was proposed by Simmonds to distinguish root rot caused by *H. sativum* and *Fusarium* species, from take-all and browning root rot. In take-all, the entire seminal root system was often killed and many crown roots destroyed. In browning root rot, the main injury was the destruction of the rootlets of both the seminal and crown roots to a depth of 30 cm below seed levels. Studies by Simmonds and B.J. Sallans, who became a staff member in 1927, showed that in the case of common root rot the roots themselves tended to escape severe attack, most damage being caused by infection at the crown and in the tissues just above and below it.

In 1933, Sallans devised a rating scale that related the severity of disease symptoms to yield losses, based on the relative yields of healthy and diseased plants. On this basis, estimated losses in Saskatchewan ranged from 5 to 15%, with an average of about 9%. In severely affected crops around Ponteix in 1942, Sallans and Ledingham estimated the loss to range from 8-24%. Simmonds and Sallans also recognized early that wheat cultivars differed in susceptibility to the disease. Consequently, many cultivars and plant breeders' lines were screened for resistance and this was later to be the basis for intensive breeding and selection programs.

Other early staff members were R.R. Hurst, G.A. Scott and H.W. Mead. Hurst stayed only for one year, leaving in 1925 to become Officer-in-Charge of the Plant Pathology Laboratory at Charlottetown, a position he held until his retirement in 1961. Both Scott and Mead studied seed-borne infection by common root rot. Mead determined the location of the fungus inside the seed and later conducted seed treatment experiments in attempts to control the disease. However, the fungicides available at the time had no protective action against infection from spores in the soil and it was concluded that seed treatment was of little economic value.

Another seed-borne disease to receive attention was loose smut of barley. The incidence of this disease in Saskatchewan increased substantially between 1935 and 1953 as a result of the introduction of cultivars with little resistance. A method was devised by Simmonds in 1945 and refined by Russell whereby unbroken embryos could be extracted from barley seeds, cleared and examined microscopically for the presence of the fungus which caused the disease. This technique was adopted by the Canada Department of Agriculture Seed Laboratory in Saskatoon to provide seed growers with a loose smut count on their seed stocks. The results also encouraged Saskatchewan seed growers to undertake the production of barley seed free from loose smut.

To further this objective the provincial authorities set aside a large section of the Kelvington district to be kept as a Barley Seed Control Area in which seed sown either had no more than 0.5% infected embryos or was treated, using hot water. This designated area was maintained for about eight years and it provided a unique opportunity to study the aerial spread of smut spores. Russell was the technical advisor to the project. However, crops became reinfected by spores carried long distances by wind. In addition, there was no premium price for smut-free seed and the project was eventually phased out.

Staff of the Dominion Laboratory of Plant Pathology, 1931. Left to right: W.T. Maguire, P.M. Simmonds, B.J. Sallans, R.J. Ledingham, Clara Shore, C. Bryce, J.A. Hempson, R.C. Russell, H.W. Mead.

In 1938 R.J. Ledingham became a permanent staff member, although he had been around as the "lab boy" since 1931 and had worked during the summer months of 1936 and 1937 as a Plant Disease Investigator. He was one of the first graduate students of T.C. Vanterpool who had started to teach plant pathology in the Biology Department of the University in 1928. Ledingham worked with Simmonds on common root rot of cereals. As time went by he also became involved with potato diseases and gradually built a reputation for being the "man with the answers" to plant disease queries from farmers and home gardeners alike.

The final two members of the Dominion Laboratory of Plant Pathology both started in 1951. The first was S.H.F. "Stan" Chinn who was a bacteriologist by training. His task was to examine the role of antibiotic-producing microorganisms, which had become the object of much research since the end of the war, in the control of plant diseases. The second was R.D. "Bob" Tinline, although he was not exactly new, having started as a student assistant in 1947. In the intervening years he had done research on the biology of the fungus which caused common root rot and in 1951 he reported the rediscovery of its sexual stage. This had been reported much earlier by Japanese workers but the discovery that there were two different strains of opposite "mating type" was new. The technique that he devised was also quite simple and reliable. Tinline's subsequent graduate work with J.G. Dickson at the University of Wisconsin led to a flurry of experimental work on the genetics of this and related species.

Throughout the history of the laboratory, crop disease surveys were regarded as being of considerable importance. At a conference of the Associate Committee on Field Crop Diseases held in April 1928, a decision was made to conduct a comprehensive survey of cereal root rots in Saskatchewan. Pathologists from the University were also involved and 524 fields were examined. In 1929 some 481 fields were inspected. Since that time, annual disease surveys, sometimes in earlier days, done quickly at whistle stops on train journeys, have accumulated a large and valuable compilation of historical information, not only on root rots but also on all other recognizable crop diseases and abnormalities.

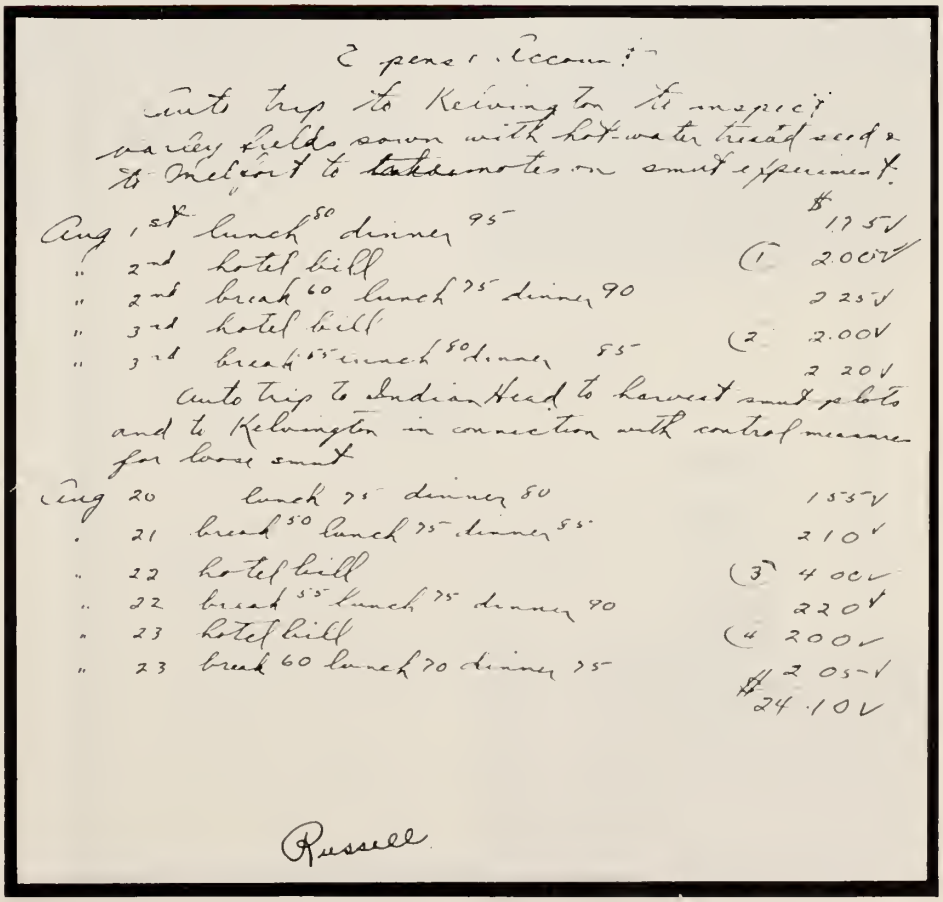
Early in its history, the Dominion Laboratory of Plant Pathology assumed responsibility for diagnostic and remedial services to the rural and urban public. In the main, all members of the staff took on this duty depending on their competence in problems of the various crops, ranging from cereals through fruits, vegetables, potatoes and ornamentals. Bacterial ring-rot of potatoes, first detected in Saskatchewan in 1940, was, and still is, regarded as a serious disease. Starting in 1940 and continuing for many years, Ledingham conducted surveys in the more intensive potato-growing areas in an effort to eradicate the disease before it became established. Today's surveys are done by the Agricultural Inspection Directorate of the Food Production and Inspection Branch, Agriculture Canada, but it is a tribute to the vigilance of earlier years that no bacterial ring-rot was detected in Saskatchewan seed potato fields in 1984 and 1985.

There was something of a family atmosphere about the laboratory that Simmonds presided over. People from outside of the family group often referred to the father-figure as "Pappy" Simmonds. He was philosophically inclined and he usually avoided rocking the boat. However, with his superiors, and occasionally with his colleagues, he could be testy and abrasive. With his subordinates he was almost uniformly mild and considerate. Sallans was quiet, tolerant and hard working. He had a good mathematical mind and it was he who directed his colleagues in plot design and statistical procedures. Mead's passion was curling. By nature he was humble and compassionate. If he could not say something kind about a person he said nothing. Ledingham had a fine analytical mind, modesty and great tact, and like Russell, was a lover of natural history and the outdoors.

Russell was perhaps more interested in systematic botany than in plant pathology, along with his intense love of the outdoors. His constant companions on any field trip were a vasculum and a plant press, plus a tea-pail and a frugal supply of food staples. He was an avid naturalist and made numerous collections of plants and fungi in Saskatchewan. He was co-author with Fraser in 1937 of the first list of Saskatchewan plants and he produced a revised edition in 1954. As his collections grew, a herbarium developed at the laboratory, containing some 7000 specimens of plants and 1000 samples of seeds and fungi. In recognition of his contributions, the collection at the Research Station was designated "The Ralph C. Russell Herbarium" in 1973.

Russell also was entranced by old prairie trails and over the years he was able to trace the exact route of the Carlton Trail from Fort Garry to Fort Carlton. His book "The Carlton Trail" was first published in 1955; a second edition was issued in 1971. He was also an ardent hunter of upland game and waterfowl. On an early morning hunt, Russell, Mead and Ledingham made a sortie, three abreast, to try and stir up some game. A sharp-tail grouse got up between them and the car. Mead blazed away but missed the bird and bagged the car which was a government vehicle! During the life of that car many people speculated on the odd markings on its left rear corner.

Plant disease survey in the early days (1925). R.C. Russell at an overnight camping site that would almost certainly have given him an opportunity for collecting plant specimens.



Expense Account

Auto trip to Kelvington to inspect barley fields sown with hot-water treated seed & to Melfort to take notes on smut experiment.

Aug	1st	lunch 50 dinner 95	$1.75 V
"	2nd	hotel bill	(1 2.00 V
"	2nd	break 60 lunch 75 dinner 90	2.25 V
"	3rd	hotel bill	(2 2.00 V
"	3rd	break 55 lunch 50 dinner 55	2.20 V

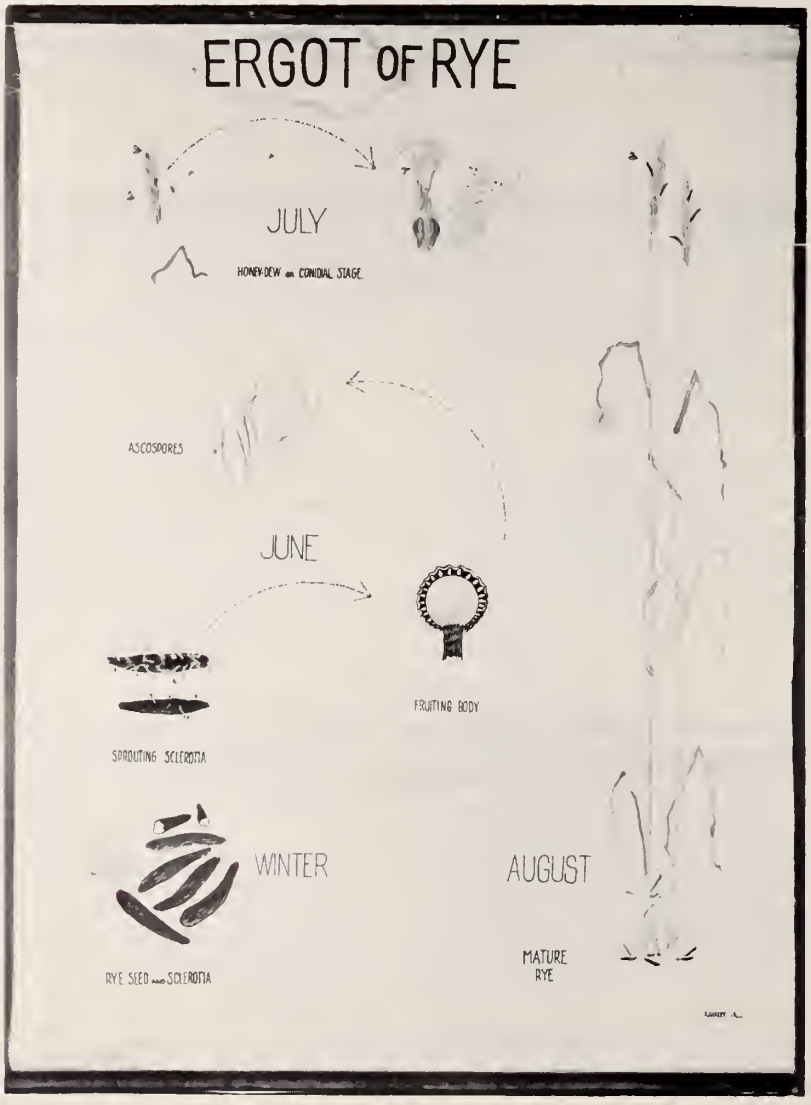
Auto trip to Indian Head to harvest smut plots and to Kelvington in connection with control measures for loose smut

Aug	20	lunch 75 dinner 80	1.55 V
"	21	break 50 lunch 75 dinner 85	2.10 V
"	22	hotel bill	(3 4.00 V
"	22	break 55 lunch 75 dinner 90	2.20 V
"	23	hotel bill	(4 2.00 V
"	23	break 60 lunch 70 dinner 75	2.05 V
			$24.10 V

Russell

An expense account submitted by R.C. Russell in 1932.

The Dominion Laboratory of Plant Pathology staff moves into the new Science Service Laboratory, 1957. Left to right; H.W. Mead, R.D. Tinline, Rose Samways, Gladys Ellard, S.H.F. Chinn, R.J. Ledingham, R.N. Hurley, M.J. Grybowski, Mrs. Hurley, B.J. Sallans, P.M. Simmonds, R.C. Russell.



Illustrated scientific chart prepared by R.N. Hurley.

The atmosphere of the laboratory was also influenced by the personalities of the many temporary or seasonal employees who were attached to it: W.G. Sallans (1927-1930) later joined the Plant Products Division and spent most of his life in Fredericton, N.B.; C. Bryce (1929-1931) later became a teacher; W.T. Maguire (1930-1935) became a physician; J.A. Hempson (1931-1934) eventually became an ordained Anglican minister with a church in Quill Lake; E.T. House (1931-1935) was on loan from the potato inspection service and later became a Manitoba Agricultural Representative; C.T. Berg (1936-1939) joined the RCAF and was reported missing after an air raid over Europe in 1943; A.W. Davey (1940-1942) had talents as an artist-draftsman and continued in this line with the Saskatchewan Government; and R.N. Hurley (1942-1958).

Hurley's duties were of a caretaking nature but he also had talents as an artist. As the years unfolded, he not only produced good charts for staff members but his watercolor paintings brought him eminence as an artist. When Princess Elizabeth and Prince Philip visited Regina in 1951 they were presented with a gift from the Province — four of Hurley's paintings depicting each of the four seasons. To a degree, the Plant Pathology Laboratory basked in the reflection of Hurley's glory. After the "Royal Presentation", the demand for his paintings was phenomenal; many people of national stature eagerly sought them. Also during Hurley's tenure came the advent of the "coffee break". Initially it was an infrequent break to mark some special occasion but gradually it became a daily routine with Hurley presiding as tea or coffee maker. In 1980 the University of Regina conferred an honorary LLD on Hurley in recognition of his contribution to Canadian art.

Hurley was also something of a poet and in the following jingle he describes the demise of an old, temperamental still which had caused him many headaches in the past.

Who broke the Still,
"I," said Eddie, "with ax I was ready."
"Good," agreed Bob, "Do a good job."
"It's sure had its day," chortled Dr. B.J.
Joined in the bustle was Dr. Ralph Russell.
Even H. Mead, with this, well agreed.
"But," wailed the Chief, "this gives me much grief."
And Dr. Stan Chinn complained of the din,
While Gladys, our steno, took notes with her pen-o,
And Hurley, with glee-o, brewed up the tea-o.

(From "Sky Painter: The Story of Robert Newton Hurley" by Jean Swanson. Reprinted with permission of the publisher, Western Producer Prairie Books)

But just as surely as time caught up with the still, so it did too with the Dominion Laboratory of Plant Pathology. The long-promised Science Service Laboratory on the University campus was finally started in 1955 and with the move into the new building in the fall of 1957, the old "Plant Path Lab" became history.

The Kemp V-belt seeder Putting in the seed is R N. Hurley; the motive power is supplied by E Chatfield (May 1954).

E. Chatfield (left) and B.J. Sallans rest on their oars on the Preston Avenue plots (May 1954).

A new tractor for plot work; H.W. Mead (left) and E. Knapp "in attendance" (May 1954).

CHAPTER FOUR

The Dominion Forage Crops Laboratory

L.E. Kirk, Professor of Field Husbandry, 1917-1931; Dominion Agrostologist, 1931-1937; Dean of Agriculture, University of Saskatchewan, 1937-1947; Head of Plant Production Branch, FAO Agriculture Division, 1947-1954.

T.M. Stevenson, Officer-in-Charge, Dominion Forage Crops Laboratory, 1931-1938; Dominion Agrostologist 1938-1957.

The Dominion Forage Crops Laboratory was established in 1931, the youngest of the three Dominion Laboratories on the University of Saskatchewan campus. At that time Canada, like most industrial countries, was experiencing a severe economic depression. In addition, large parts of the wheat-growing area of Western Canada were suffering from the effects of a severe drought which had caused widespread soil drifting and greatly reduced crop yields. As a result, government revenues were reduced dramatically. The Saskatchewan government had to cut expenditures drastically and everyone felt the pinch, including the University. It was obvious that some programs would have to be cut and one possible candidate for the axe was the forage crops research being done in the Field Husbandry Department.

It was at this point that the key figure in the establishment of what was to become the Dominion Forage Crops Laboratory came on the scene. He was Lawrence E. Kirk, a professor of field husbandry at the University. Kirk had already earned an international reputation as a geneticist and forage breeder. Perhaps his greatest success was developing the crested wheatgrass cultivar, Fairway. Despite setbacks, such as a fire in 1925 that destroyed the warehouse holding most of the seed stocks, Fairway crested wheatgrass was later to reclaim vast areas of the Palliser Triangle, which had been turned into a dust bowl during the dirty thirties. But that was to be in the future. In 1931 the whole future of the forage program was at stake.

Then, in that same year, Kirk was offered the position of Dominion Agrostologist who was responsible for promoting and supervising the forage crops research at the Central Experimental Farm in Ottawa and on the Experimental Farms and Stations across the country. This offer gave Kirk the opportunity to mastermind an agreement which would have the twofold effect of maintaining a forage research program on campus and allowing him to keep in close touch with it. The meat of the agreement was this: the University would discontinue the forage research, thereby saving some money, and the Dominion Department of Agriculture would establish a forage crops laboratory on the campus. The plan had the full blessing of the Minister of Agriculture, the Hon. Walter Weir, as well as that of the President of the University, Dr. Walter A. Murray, and in 1931 the Dominion Forage Crops Laboratory was born.

The agreement stipulated that all of the forage research as well as the teaching of forage courses would become the responsibility of the federal department. It was further stipulated that the University would provide land for field work and a greenhouse, as well as office and laboratory space in the Field Husbandry Building which had just been completed in 1929. For this accommodation Ottawa agreed to pay an annual rent of one dollar. It was further agreed that the staff currently involved in forage work at the University would become federal employees. To carry on the field work, the University agreed to make available horses, teamsters and equipment as required.

The first Officer-in-Charge was Trueman M. ("True") Stevenson. He had been employed as Field Superintendent for the University's Field Husbandry Department for several years and he was familiar with Kirk's breeding and research program. Helen Savage was appointed as Stevenson's secretary and Kirk's two former technicians, Charlie Sendal and Frank Rose, simply transferred from the University to the Laboratory's payroll.

Aerial view of the east section of the University of Saskatchewan campus showing part of the Field Husbandry plots (1928). (Courtesy University of Saskatchewan Archives).

L.E. Kirk in a sweetclover nursery in the early 1930's.

Cultivating a sweetclover nursery in the early 1930's.

Crested wheatgrass seed increase field on the C. McLean farm at White Fox (May 1938). Kirk stands at left.

The Laboratory continued the research projects begun by the University, and over a period of time added new ones. The aim was to develop improved cultivars of alfalfa, sweetclover, bromegrass, crested wheatgrass, and slender wheatgrass. Particular emphasis was placed on yield, forage quality, and resistance to drought and diseases. In addition, the Laboratory continued the evaluation of various species and cultivars for hay and pasture, and cooperated with the Experimental Farm at Indian Head and the Swift Current Station to provide information on establishing a protective grass cover on soils where drifting had occurred.

With the passage of the Prairie Farm Rehabilitation Act in 1935, funds were available to hire a second professional staff member. W.J. "Bill" White received the appointment in September 1937 upon his return from a year of graduate study at the University of Minnesota. In that era, PFRA employees were not accorded Civil Service status. Whether it was for this or for some other reason is not known, but White's first paycheque was not received until nearly Christmas of that year.

The agreement between the Dominion Forage Crops Laboratory and the University was unique in that, in exchange for space in the Field Husbandry Building, the Laboratory undertook to teach the equivalent of up to two full classes on forage crops. This arrangement remained in effect from 1931 to 1964 and it continues, in part, to the present day with certain staff members being accorded Adjunct Professor status in the Department of Crop Science and Plant Ecology.

One result of the University classroom involvement by staff members was that it made students aware of what the Dominion Forage Crops Laboratory was doing. This was particularly true for those undergraduates who obtained summer employment at the Laboratory. Such students were required to have a good academic record, and many of them later entered graduate school. Most of these had thesis research topics dealing with forage crops, and later oilseeds, and were supervised by Laboratory staff members, thereby increasing considerably the Laboratory's research productivity. Even more significant was the fact that the motivation, training, and experience

Harvesting crested wheatgrass in the early 1930's.

The value of Fairway crested wheatgrass (right) giving a hay crop and controlling weeds contrasted with abandoned land on the left (August 1948).

Russian thistle stacked for hay (August 1937).

Alex Campbell (left) and Charlie Sendal threshing crested wheatgrass (August 1940).

gained by these graduate students often led to their securing research positions working with forage and oilseed crops within Agriculture Canada, or at universities. A chronology of much of the research carried out by the Laboratory and its graduate students is found in Appendix A which lists the students from 1931 to 1984. This preparation of future generations of research scientists, university lecturers and administrators was a major contribution of the Dominion Forage Crops Laboratory.

But there were times when the teaching became burdensome. In 1938-39, J.B. Harrington of the Field Husbandry Department was granted a sabbatical leave and the University asked Stevenson to teach Harrington's biometry class, in addition to the classes on forage crops. This was agreed with the understanding that White would help with the teaching. However, in the fall of 1938, Stevenson was named the new Dominion Agrostologist to succeed Kirk who had returned to the University of Saskatchewan as Dean of Agriculture. With Stevenson's departure for Ottawa, White was confronted with a very heavy teaching load, in addition to his research and the administrative tasks required of him as the new Officer-in-Charge.

When the Forage Crops Laboratory was first established it had a plot area of 17.5 hectares just east of Preston Avenue. The land itself was not particularly good for research purposes. The soil was highly variable and great care had to be taken in selecting a site for a particular experiment. Another 2.2 ha were added in 1947 and then in 1953 an additional 6-ha block, previously occupied by the Plant Ecology Department, was turned over to the Laboratory. Unfortunately, the latter land had several areas which were completely sterile, a legacy of early herbicide research. On the original site there was one small building which served as a field shed and a small workshop. A machinery shed was built later, in the fall of 1949. Building that

shed got White into considerable hot water. Although he had talked generally with officials in Ottawa about the need for such a building, he had absolutely no authority to proceed with it. However, the money became available and he went ahead anyway. The reaction from headquarters was predictably loud, but short of tearing the building down, there was little that could be done about it.

The forage greenhouse foreman was Frank Rose. Frank was a great storyteller, with his own ideas about the work ethic — "I came late so I shall quit early to make up for it". The tractor operator was Alex Campbell who had a fine disregard for the rules of the road as he drove across Preston Avenue. He never looked right or left and never suffered a scratch. The "farm foreman" was Charlie Sendal, a London Cockney who could not stand the English. He retired in 1950, and then George Morrison took over. A veteran of both World Wars and a former sergeant major, George never left any doubt about who was in charge. This was brought home most forcibly to the brother-in-law of one of the staff members on an occasion when he was rash enough to challenge George's authority. He was literally thrown out of the shed.

Top:
Left to right. Art Marshall, John Unrau and Bob Knowles outside the Field Husbandry Building (Summer 1939).

Bottom:
Frank Payne (left) and Bob Savage excavating crested wheatgrass plants for a root growth study (August 1939).

Breaking land for alfalfa production at Weirdale (May 1938).

In 1938, a young farm boy from Unity, R.P. "Bob" Knowles, began work on the plots as a freshman student. His contemporaries were John Unrau, Bob Savage and Frank Payne. In those days students worked 10 hours per day, 7:00 am to 6:00 pm, with one hour off at noon; they only worked for five hours on Saturdays. The approximate rate of pay was 20 cents an hour. There were no coffee breaks, only a few minutes off now and then for a drink of water. Hoeing was an almost never-ending job since herbicides did not come into common usage until after 1946. Preparations for planting would also be back-breaking work. Someone had developed a method of "chaining" to ensure that plants were located an equal distance apart. It involved two people dragging a heavy chain stretched across a 40-m plot, first one way and then again at right angles to mark every 91 cm. The later development of modern methods of row marking was most welcome!

When Knowles first started in 1938 he worked on alfalfa, particularly with regard to pollination and seed-setting problems in the Smeaton-Nipawin area in northeastern Saskatchewan. In the period of severe drought on the open prairies between 1931 and 1937, many farmers pulled up stakes and moved north to the edge of the forest belt. As land was cleared and broken, the settlers commonly seeded alfalfa to provide hay for their livestock. They soon realized also that if the alfalfa was not harvested for hay, they could get good yields of seed. There was a ready market for alfalfa seed and this led to an expansion of the number as well as the size of fields. However, as this happened, seed yields dropped, often dramatically. The research for Knowles' Masters thesis was designed to find out the cause of the problem and to come up with a solution. He established that wild bees were important in alfalfa pollination and seed production. When fields were only 2-3 ha in size and close to undisturbed forest, which provided nesting sites for the wild bees, good

Alfalfa seed production experimental area at Snowden (September 1944). In the background is an ideal natural nesting habitat for wild bees.

W.J. White, Officer-in-Charge, Dominion Forage Crops Laboratory, 1938-1956; Head, Department of Field Husbandry, University of Saskatchewan, 1956-1965; Dean of Agriculture, 1965-1974.

George Morrison crossing intermediate wheatgrass plants in 1951.

seed yields were generally obtained. However, as more land was cleared and fields increased in size, there were simply not enough wild bees to do the pollinating. As a result of Knowles' work, alfalfa seed producers adopted methods to provide adequate bee-nesting sites. They either left strips of undisturbed woodland between areas seeded to alfalfa or piled downed trees into windrows and planted a relatively narrow strip of alfalfa between them.

These studies were continued by J.L. "Lin" Bolton who joined the staff in 1942. He reasoned that the size of the leafcutter bee population might be limited also by a poor supply of tunnel-nesting sites, which were usually provided by wood-boring insects. If this were the case, the bees might be induced to use man-made tunnels in logs or trees. His experimental plan involved drilling a number of holes into an abandoned log cabin and he found that indeed the bees did use these holes as nesting tunnels. Some 20 years later this idea, in a somewhat modified form, came into widespread use in Western Canada with artificially reared leafcutter bees, and seed yields increased markedly.

A serious threat to alfalfa production was the disease called bacterial wilt. By about 1940 it had been established that under irrigation in southern Alberta this disease caused a progressive and serious decline in alfalfa stands. In 1947 the disease was found in an irrigated field at North Battleford and in several non-irrigated stands across northern Saskatchewan. As a result of this, a breeding program to obtain resistance was begun in 1946. Initially the testing was done on irrigated land at Lethbridge. However, by 1953 screening was being done in the greenhouse using the "root-ball soak method" developed by M.W. "Bill" Cormack at Lethbridge. This technique was used at both Lethbridge and Saskatoon, although some field plot work continued. After extensive testing of Bolton's breeding lines, one superior synthetic was chosen and licensed in 1961 under the name "Beaver". This variety is still recommended for Western Canada, a good example of the results of cooperative effort between two Research Stations.

When Bolton took over the alfalfa research, Knowles turned his attention to the forage grasses, particularly bromegrass and crested wheatgrass. His bromegrass breeding program started in 1942 and was to come to fruition almost 20 years later with the release of the cultivar Carlton. Kirk's bromegrass research in the 1920's had concentrated on plants with restricted creeping habit and the cultivar Parkland came out of this selection program. However, increasing emphasis came to be placed on leafiness, forage and seed yields as well as disease resistance. By the late 1940's few of Kirk's strains remained in the breeding program.

Compared to bromegrass, crested wheatgrass was not much of a hay producer but as a pasture grass it was unexcelled. Kirk's cultivar Fairway had already proved its worth in the land reclamation efforts of the 1930's and 1940's and it is still the best adapted and most widely grown dryland grass on the prairies today. Knowles' selection and breeding work produced the cultivar Summit in 1953. While Summit is still grown to some extent it never became really popular because of difficulties in seed cleaning, but it is still a top forage yielder.

In the 1920's there had been considerable effort to select superior plants of slender wheatgrass. One cultivar was Mecca, released by the Field Husbandry Department in 1929. The Dominion Forage Crops Laboratory took over the slender wheatgrass program, but it was discontinued in the early 1940's when it became apparent that there was only limited variability in the material, and that on the average it survived for only 4-5 years.

In the mid 1930's, Russian scientists reported that they had successfully intercrossed certain wheatgrasses with common and durum wheats with the aim of producing a perennial wheat. The same idea of using these crosses to obtain a large-seeded perennial grass also occurred to Stevenson and White and they started a hybridization program in 1936-37. White was later to use this project as the basis for his PhD thesis, but by 1950 it was evident that the original objective of attaining a large seeded perennial grass had not been accomplished and the project was abandoned in 1950-51.

A sweetclover breeding program was one of the initial programs of the Dominion Forage Crops Laboratory when it started in 1931. Kirk had already produced the high yielding, winter-hardy cultivar Arctic around 1920. However, Arctic was not very palatable and one aim of the new program was to remedy this deficiency. Another, more important goal was to eliminate the hazard of "Sweetclover Disease", which occurred when spoiled sweetclover hay was fed to cattle, causing them to die from internal bleeding. It had been shown by an Ontario veterinarian in 1923 that the disease was related to the coumarin content of sweetclover. In 1933-34, White tested a large number of single sweetclover plants and found one which gave a low reading for coumarin content. This lead to the development of a cultivar named Pioneer which was released in 1940 under contract for multiplication. However, a newly developed test revealed that Pioneer actually contained normal levels of coumarin but in a "bound" form which the old assay did not detect and plans to distribute seed were abandoned.

Another *Melilotus* species (*M. dentata*) was known to be coumarin-free, and this character had been transferred to the common white-flowered sweetclover (*M. alba*) by scientists at the University of Wisconsin. Using five plants from this cross as the parental material, a breeding program was started in 1946 to incorporate the low coumarin character into commercial sweetclover cultivars. In 1948 the program was assigned to Savage, and when he resigned in 1950, it was taken over by J.E.R. "Ross" Greenshields. In 1957, Greenshields left Saskatoon to become the Head of the Grass, Legume and Pasture Research Unit in Ottawa, and in 1960 he became the Research Co-ordinator for Forage Crops. However, a Masters degree research project by one of his students, B.P. "Bernie" Goplen, led to the licensing of the first low coumarin cultivar, Cumino, in 1957.

Field Husbandry Building, University of Saskatchewan (1937). Home of the Dominion Forage Crops Laboratory, 1931-1957.

Construction of the Machinery Shed on the Preston Avenue plots (October 1949).

Staff of the Dominion Forage Crops Laboratory (1954). Left to right: W. Nemanishen (student), W.J. White, H. Baenziger (student), J.E.R. Greenshields, Sheila Pizzey, G.G. Morrison, R.I. Bowman, J.L. Bolton, R.P. Knowles.

Bill White supervises grass seeding at the Saskatoon Airport (May 1950).

Two continual problems with "low coumarin" sweetclover plants in small breeding nurseries were caragana blister beetles and rabbits. The blister beetles relished them and their ragged, chewed appearance was just as good an indication of their coumarin content as was the chemical test. Rabbits also preferred the low coumarin plants and requisitions for rabbit-proof fencing met with amused disbelief by the administrative officer of the day!

A major problem in developing new varieties of cross-pollinated crops was preventing unwanted pollination by other crops in the vicinity. Suitable isolation plots were needed and in the early years availability of land at the Sutherland Forestry Farm helped meet this need. Later, White arranged for isolation plots on the University Sheep Farm at Beaver Creek. Eventually 20 plots were established among the sand hills and staff members occasionally got lost. Knowles spent several days in the fall of 1945 plotting the position of plots and roads with a Brunton compass, only to discover next spring that the whole area had already been surveyed from the air. Many excellent isolation sites were also located in the sand dune area south of Saskatoon, the property of the Department of National Defence. This site gave more than one staff member a valuable lesson in digging the truck out of sand traps. Another hazard in the sand dunes were the honey bees that were used for pollination. These were confined in small screen cages set up over the plants and when they escaped, as they did occasionally, they were in a particularly bad temper. One very tall, lanky student assistant, in particular, had to rely on long legs and flailing arms to get him to the safety of the field house. A lot of good work came out of these isolation plots and staff and students alike gained valuable experience. However, they were eventually abandoned around 1963 because of drought, pocket gophers and the general hostility of the military.

Beaver Creek alfalfa isolation plots (1957).

Ross Greenshields in low coumarin sweetclover plots (May 1957).

Winterkill of Kentucky bluegrass, Griffiths Stadium (May 1957).

The Dominion Forage Crops Laboratory was also the birthplace of today's multimillion dollar oilseeds industry. This came about because before the Second World War, crops such as soybeans, rapeseed, and sunflowers were used only for forage with no regard for their potential as sources of oil. Sunflowers had been grown in gardens since the days of the early Mennonite settlements in Western Canada. At first the seeds were eaten as a confection but with the coming of World War II they were looked at closely as a source of vegetable oil to make up the shortage that developed quickly in Canada. Until then, sunflowers were not grown on a field scale anywhere in Canada and probably not in the USA either. This was being done in Russia and it seemed a good bet that it would work in at least parts of the Prairie Provinces. The idea proved to be feasible and in 1941 the Forage Crops staff took off a little more than a hectare of sunflowers at the Forestry Farm, using a combine harvester; almost certainly the first time a sunflower crop was ever harvested that way.

The seed stock for the first commercial sunflower production on the prairies was obtained from Mennonite settlements and the term 'Mennonite' stuck to the new crop. At first, very few farmers were interested in experimenting with production on a field scale. The Wartime Prices and Trade Board was committed to purchase the seed that farmers did produce, but the widely scattered and small-scale production presented problems in getting the seed together and transporting it to Eastern Canada for oil extraction. For a time this placed a damper on production but the crop was clearly well adapted to production in certain areas, particularly the Red River Valley of south-central Manitoba. In the Altona district a group of farmers formed a cooperative, constructed an oil extraction plant and recruited Eric Putt to guide the new enterprise. Putt had been a student at the Dominion Forage Crops Laboratory under the supervision of White and Stevenson and his Masters thesis project was on sunflower breeding. For the next 35 years he was to be the driving force behind sunflower breeding and production in Western Canada.

The sunflower breeding program of the Forage Crops Laboratory in Saskatoon began in 1936 when a number of single sunflower heads were collected from garden plots in the Rosthern area. Plants were selected on the basis of early maturity, seed yield, oil content, head size, etc. Individual plants were self-pollinated and developed into a series of inbred lines. One of these lines was given the name "Sunrise", in 1940, although it was never released to farmers. These inbred lines were uniform and quite desirable in many respects but their low yield was a drawback to commercial use. Then it occurred to White that they could be used as parents to produce hybrids with higher yields and oil content. Much of this work was done by Unrau, first as an undergraduate and later for his Masters thesis which he completed in 1945. By that time, Putt was also conducting a similar program at Altona and with the benefit of hindsight, it is apparent that the Dominion Forage Crops Laboratory is to be credited with starting the work that led to today's widespread production of hybrid sunflowers.

Harvesting sunflowers on the V G Ross farm at Hodgeville (November 1942).

Harvesting sunflowers on the J Richards farm at Borden (November 1943).

The development of rapeseed as an oilseed crop on the prairies was also triggered by World War II. Rapeseed oil was an essential lubricant for marine engines, and the disruption of ocean shipping as a result of the war threatened to cut off Canada's supply from Europe. In 1942, Stevenson secured a supply of seed of *Brassica napus* from Argentina and distributed it the following spring. The first Canadian rapeseed crop was grown in 1943 on 1300 ha in Saskatchewan and Manitoba; by 1948 it had increased to 32,000 ha.

Because of its origin, the first lot of seed was called "Argentine" rapeseed and the name stuck. In the meantime, a Shellbrook district farmer, Mr. Fred Solvoniuk, had been growing a different type of rapeseed in small plots on his farm since 1936. He had obtained the seed originally from a friend or relative who had brought it with him when he emigrated from Poland in 1927. As information on rapeseed cultivation became more available after 1943, Mr. Solvoniuk began field scale production of his rapeseed strain, and sold seed to his neighbors. It was quite different from the Argentine type and it soon became known as "Polish" rapeseed. It was determined later that it was a different species, *Brassica campestris*. It was much earlier than *B. napus* and it rapidly gained favor with farmers in the more northern growing areas.

It was well known at the time that rapeseed was an important source of edible oil in other parts of the world. With the end of the war, and with it the critical need for marine engine lubricants, White, with an eye on the edible oil market, started a modest research program to breed a better rapeseed. The original material appeared highly variable and it was obvious that improved selections could be made from it. Mr. H.G. Neufeld of Nipawin was one of the original growers of Argentine rapeseed in 1943. With great foresight he had selected 40 single plants from that crop and kept the seed of each separate. He offered the seed to White, who grew it out in the first rapeseed yield test in 1944.

At first, selection was limited to Argentine rapeseed, partly because it was the only type available initially. It was also fairly self-fertile and this made it relatively easy to develop pure lines. Selecting lines for higher seed yield and earlier maturity was routine, but determining oil content and oil quality was another matter. At that time, methods of analysis were cumbersome, requiring a lot of time and a large sample of seed. As a result, progress in breeding was very slow at first and it was not until much later that highly sophisticated methods of analysis enabled the production of today's greatly modified cultivars. Nevertheless, progress was made and Golden, the first licensed cultivar, was released in 1954.

White had taken over as Officer-in-Charge of the Dominion Forage Crops Laboratory in 1938 and remained in that capacity for nearly 20 years. Under his direction great strides were made in forage crop improvement and the benefits are still evident today in improved cultivars of alfalfa, sweetclover, crested wheatgrass and bromegrass. White himself laid the foundation for Western Canada's oilseeds industry, both with sunflowers and rapeseed. Today, the rapeseed program, once the "Cinderella" crop, is the largest at the Research Station and Saskatoon has become recognized world-wide as a center of excellence for research on this crop. The ties with the University were maintained and even strengthened during White's years as Officer-in-Charge and two generations of leaders in forage and oilseeds research emerged under his tutelage. There was perhaps something symbolic about his resignation in 1956 to become Head of the Field Husbandry Department, and later Dean of Agriculture, barely a year before the Dominion Forage Crops Laboratory passed into history.

Charlie Sendal harvesting rapeseed plots in the early 1940's.

CHAPTER FIVE
The Saskatoon Science Service Laboratory — 10 Years in the Making

Plans for building the Saskatoon Research Station, or the Science Service Laboratory as it was first designated, were first discussed in 1947. However, the seeds of the idea had been planted some 10 years previously in 1937, when the Department of Agriculture underwent a major reorganization. Several "Services" were set up to supersede the old "Branches" as they had been known since the formation of the Department. Botany and Plant Pathology, formerly the Botany Division of the Experimental Farms Branch, and Entomology, formerly the Entomological Branch, became part of the new Science Service. The Forage Plants Division remained as part of the Experimental Farms Service.

In 1947 a building committee, headed by Arnason, was set up to plan the new Laboratory. The University was keenly receptive to the idea as indicated in the following extract from a letter dated January 22, 1948, from V.E. Graham, acting Dean of Agriculture, to Arnason:

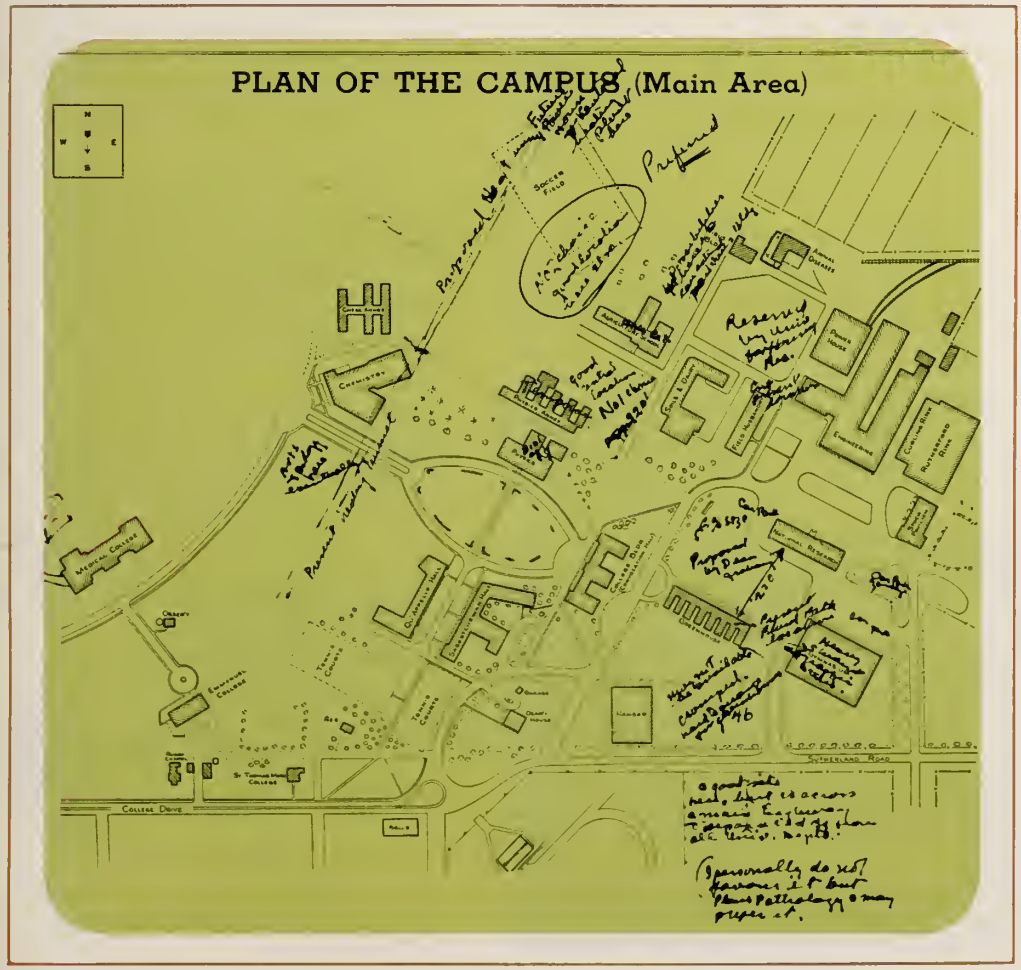
> "You approached me some time ago with respect to the attitude of the University towards the construction of a building by Science Services on this campus. I have discussed this matter with President Thompson and am pleased to be able to state that the University welcomes the proposal and will co-operate with Science Services in facilitating such a development."

The person who was responsible for the planning of the Science Service laboratories was W.E. van Steenburgh, Associate Director of the Science Service. In a letter to Arnason, dated September 9, 1949, he wrote:

> "In recent discussions it has been decided to proceed with the plans for a laboratory at Saskatoon with the hope that within the relatively near future construction can begin. Our present desire is to start, if possible, the architectural plans in October and complete them sometime before next summer. If we secure authorization by Parliament for the funds, there is the possibility we might be able to start construction in 1950. I should point out, however, that it normally requires many months for the preparation of plans and specifications and for this reason, as well as the uncertainty of securing funds, I do not wish to build up unduly your hopes and enthusiasm. All we can promise at this time is our best efforts to promote the project."

Eight days later Arnason's committee sent van Steenburgh a plan of the campus showing possible sites for the proposed laboratory. Then, however, things began to go wrong. On June 20, 1950, van Steenburgh wrote to Arnason:

> "Progress on the plans for the building is very slow. About a month ago the architect on the job left Public Works. Another man is trying to pick up the threads and proceed with the work. I should think it very unlikely that any excavation or work on the basement can be undertaken before freeze-up. I give you this information so that you will not be unduly disappointed later. For planning purposes, as far as the groups at Saskatoon are concerned, I doubt if it will be possible to occupy the building until late 1951 or early 1952."



The plan sent by Arnason to Van Steenburgh in September 1949. The "preferred" choice of Dr. Neatby (Director of Science Service) was the Number 2 site.

The desire of Arnason's committee to speed things up drew some mildly chiding words from van Steenburgh in a letter of July 10, 1950:

> "In your last paragraph you urge that certain steps be taken which you hope will facilitate early construction. Apparently you have never heard of the story of the English king who ordered the tide to stand still! No amount of urging on your part or our part will hurry construction. The Department of Public Works moves at a certain and, we hope, progressive speed. Cheering or exhortations from the sidelines have no effect on progress. If anything, at any time, can be done to facilitate and thus speed construction, steps will be taken from this office.
>
> I suggest you just lean back and relax because any other attitude on your part will only cause you to become exasperated and will have no effect whatever on the speed with which the building is completed."

Other frustrations were to tax Arnason and his committee. In a letter to van Steenburgh he writes:

> "Another matter was mentioned by him; namely, that P.F.R.A. had made test holes and provided information, as a result of those borings, on the character of the soil and subsoil. However, these test holes had been made at the south edge of the property where the greenhouses are expected to go, and no borings had been made at the proposed site of the building along the west edge of the site. As a result they have no information on the soil condition at the location which the building is to occupy according to our plans. Just how it came about that P.F.R.A. was instructed to make their borings along the south end of the property is a mystery here."

The Science Service building under constructions; winter 1955-56. (Courtesy H.H. Weegar)

The Science Service building under construction; April 1956. (Courtesy Saskatchewan Archives Board, Star-Phoenix Collection).

An optimistic note was struck in a letter of December 4, 1950 from van Steenburgh to Arnason:

> "I had occasion to see the plans this morning. Except for the mechanical details, they are completed. We hope to ask for authorization to secure tenders sometime next spring. Whether we can proceed with the building, will, no doubt, depend upon the seriousness of the international situation."

The "international situation" was the Korean War which had broken out in June 1950, and on April 17, 1951, van Steenburgh wrote to Arnason:

> "I am sure you will understand that it was with great reluctance that we postponed our plans for building at Saskatoon. We hope this postponement represents only a short period of time. The building which we had planned was to have a structural steel frame and it is impossible, at this time to procure the necessary priority to get that type of steel. As soon as conditions improve and there appears a chance for us to secure the necessary priorities, the matter will be pressed again with vigour."

On March 17, 1953, another delay surfaced because of a "misunderstanding" about the exterior appearance of the building (C.B. Grier, Administrative Officer, Division of Entomology, to Howard McDonald, who by this time had become largely responsible for the development of the building plans):

> "As I recall our conversation while looking over the proposed site of the new Science Service Laboratory at Saskatoon, you mentioned that the new building would be constructed of stone, or a least faced with stone, similar to that used on the other buildings in that section of the campus, and that the use of this material had been stipulated by the University authorities as one of the conditions governing permission to build on that location. I happened to mention this to Dr. van Steenburgh, who stated he had received no such advice from University of Saskatchewan authorities and that the building plans called for a structure of reinforced concrete and brick."

The Science Service building under construction (left); summer 1956. The outer stonework nears completion. (Courtesy D. Martin)

View of the newly completed first section of the headerhouse and the first two greenhouses as seen from the roof of the Chemistry Building. Woody Stewart's vegetable insect garden can be seen at right (summer 1956). (Courtesy D. Martin)

View from just outside the front door looking towards the Chemistry Building. In the mid foreground is the Chemistry Annex, one-time home of the Forest Pathology Laboratory. Note that there are no buildings to obscure the view of the Medical College at right (Spring 1958).

The Saskatoon Research Station (March 1959). (Courtesy H.H. Weegar).

A year and a half later on December 17, 1954, McDonald wrote to D.P. Nigra, Head of the General Services Unit, Science Service:

> "During the course of my conversation with Mr. McEown he of course asked what has long since become the Number One question around the campus: 'when are they going to start construction of your building?' It has become an embarrassing question because we have no satisfactory knowledge of the situation other than the fact that some money was voted for this construction."

On March 4, 1955, van Steenburgh was assured by the Chief Architect of the Department of Public Works that "every effort will be made to have the job out for tender by the beginning of April". Nevertheless, on May 2, 1955, President Thompson wrote to K.W. Neatby, Director of the Science Service:

> "I am writing again about the Science Service building proposed for our campus. While we hope that a start will be made this summer I am particularly concerned about .... the space now occupied in our greenhouses by Federal men."

Finally, excavation did start in the summer of 1955 and the first occupants moved into the building in July of 1957. It had 5575 sq m of floor space and contained 60 offices, 30 laboratories and 16 utility rooms; there were 700 interior doors including those to pipe chases. At a cost of $1,300,000 it was to be the last building to be constructed on the University of Saskatchewan campus according to the original campus plan of 1909. There was no official opening ceremony; instead a week-long open house was held in January 1958. The cornerstone reads "Canada Department of Agriculture Research Laboratory". In 1959, as a result of a major reorganization within the Department, the Science Service and the Experimental Farms Service were amalgamated into the new Research Branch and the establishment was officially designated a Research Station.

CHAPTER SIX

The Sections and a New Administration

M.W. Cormack, Chief (later Director) of the Canada Agriculture Research Laboratory, 1957-1964.

When the Dominion Laboratories were brought together under one roof they were each labelled, somewhat prosaically, Sections. They retained some of their identity but instead of reporting directly to Ottawa, the Section Heads reported to the Chief of the Laboratory. There was a central Administration section to take care of the day-to-day business of running the Laboratory, thereby leaving the Research Officers free to concentrate on their research programs. In earlier days, Simmonds and other Officers-in-Charge had to handle even the smallest of administrative tasks, witness this memo from the Dominion Botanist dated March 9, 1948.

> "On checking your Imprest Account for the month of February, it was noticed that on R.C. Russell's expense account an error of $ .10 had been made in the addition of the item which read as follows:
>
> "February 22, Breakfast .85; Lunch .90; Dinner .75 = $2.60".
>
> The total of these three meals should be $2.50. Kindly make the necessary adjustment on the next account submitted by Mr. Russell."

The first Chief (as the Director was known then) was M.W. "Bill" Cormack, a plant pathologist by training. He came to Saskatoon from Lethbridge where he had cooperated with Bolton in developing the alfalfa cultivar Beaver, which was resistant to bacterial wilt. He already knew many of the staff and his first task was to get to know the new, and as yet unfinished, building. His first sight of the dungeon-like sub-basement, viewed by flashlight, with its tangle of pipes, wires and conduits, was like something out of a nightmare. As long ago as September 27, 1949, van Steenburgh had written to Arnason "However, I am afraid that it will not be possible to consider a sub-basement". Successive building superintendents would come to wish that the designers had stuck to the original plan.

The first Administrative Officer was J. Brian Hartley who had been employed originally by the Dominion Entomological Laboratory as a chemist. The stenographers who had been employed by the individual Dominion Laboratories were organized into a "Steno Pool" under an Office Supervisor, Bella Ross, who was also from the Dominion Entomological Laboratory. Dr. Cormack's first secretary was Esther Fazakas. However, she resigned after only a short time and was succeeded in 1959 by Gladys Hall who had been a stenographer, first with the Dominion Entomological Laboratory, and then with the Dominion Laboratory of Forage Crops. The new system seemed to work well although there was some resistance to changing the ways of doing things. A welcome addition was the appointment of a receptionist, but even there things were not perfect. As noted in the minutes of an October 1957 meeting of the Section Head Committee "Miss Kononoff's performance as a receptionist was commended by all; it was suggested, however, that her greetings to outside telephone callers could be shortened".

There were four Sections in the new building, as well as members of the Marketing Service, Economics Division, and the PFRA Soil Mechanics Division. In April 1960, the Soil Survey Unit became part of the administrative responsibility of the Research Station but its members continued to be housed in the John Mitchell Building on the University campus. The four Sections were Entomology, Botany and Plant Pathology, Forage Crops and Forest Biology.

J.B. Hartley, Administrative Officer, 1957-1958.

D.F. Edwards, Administrative Officer, 1958-1961.

The Forest Biology Section was different from the other three in that its Section Head reported directly to Forestry Service Headquarters in Ottawa and not to the Chief or Director. Previously known as the Forest Pathology Laboratory, it had had a checkered career since its establishment in Saskatoon in 1948. In 1947, C.G. "Cliff" Riley had been commissioned to travel through the Prairie Provinces and to recommend a location for a new Forest Pathology Laboratory. Riley recommended that Edmonton would be the most logical location but higher wisdom decreed that the laboratory should be in Saskatoon.

Riley and his student assistant W.B.G. (Bruce) Denyer were under the impression that arrangements had been made for accommodation at the University. Apparently Simmonds had contacted Dean Thompson in February at the request of Craigie, the Dominion Botanist. However, when Riley and Denyer arrived in June 1948, after driving over gravel roads from Winnipeg, they found that nobody at the University knew anything about them. Through the kindness of Dr. Spinks, who was then Head of the Chemistry Department, they were loaned the use of what was little more than a cubicle in the Chemistry Annex, a "temporary" army hut. From there the group moved to no less than three different locations in the as yet unfinished Prairie Regional Laboratory of the National Research Council of Canada on the University campus.

However, with a growing staff and an expanding research program the need for extra space became critical. In 1951, the space problem was "solved" and the laboratory moved to downtown Saskatoon above Birk's Jewellery Store, remaining there until 1957. As Riley was later to put it:

"Our troubles we related to our
friends at Public Works,
Who cheerfully proceeded to
eliminate the quirks;
And that is how we got our lab at
Henry Birks."

Other staff members during the period 1948-1965 were, R.D. Whitney, H.S. Whitney, H. van Groenewoud, H. Zalasky, L.O. Vaartaja, P.J. Salisbury, M.I. Timonin, R.L. Black and H.H.V. Hord. Much of the research was devoted to spruce decays and nursery diseases. The latter investigations yielded practical results from which immediate returns could be realized in the production of planting stock. Vaartaja and Timonin not only investigated diseases but followed through and directed the application of their recommendations in provincial and federal nurseries with very substantial improvement in quantity and quality of seedling crops.

When Riley retired in 1964 he was succeeded by Denyer. Then, in 1965, the Saskatoon laboratory was closed abruptly and the staff and equipment were transferred to other regional stations, mainly Winnipeg, in a general consolidation of regional units of the Forestry Service.

C.G. Riley, Officer-in-Charge, Forest Pathology Laboratory, 1948-1957; Head, Forest Biology Section, 1957-1964.

The Administrative Section, 1963. Seated (left to right), C. Schaeffler, Gladys Hall, M.W. Cormack, Betty Carnie, J.C. Boyer. Standing (left to right), Pat Campbell, W.H. Leonard, Mavis Kononoff, Minnie Herman, F. Dolezsar, Rose Fidgett, Sharon Hannah, Bella Ross, E. Jensen.

The Forest Biology Section, 1964. Seated (left to right), Anne Leonard, Pat Campbell, M.I. Timonin, C.G. Riley, W.B.G. Denyer, Mavis Kononoff. Standing (left to right), D.E. Dreger, R.D. Whitney, O.K. Fenn, J. Belcher, G.L. Gilkinson, H. van Groenewoud, H.H. Weegar, G. Glen, H. Zalasky, W. Millikin.

Other important events occurred during the first few years after the Research Station opened in 1957. (The Science Service Laboratory became the "Research Station" in 1959 when the Research Branch was formed by amalgamating the Science Service and the Experimental Farms Service. The "Chief" became the "Director" at that time). One was the establishment of a station library, thereby consolidating the holdings of the three Dominion Laboratories. The first Librarian was Betty Carnie, from 1957 to 1965. She was followed by Arlean McPherson who did much to strengthen and modernize the library. Before she left in 1979 she had established the library as a center of excellence for documentation of research on oilseed crops and had introduced many staff members to the value of the computer for storing and sorting bibliographic information.

Another important event was the creation of the position of "Scientific Information Officer" in 1959. Traditionally, inquiries and requests for advice from extension people, farmers and the general public had been handled by the appropriate Laboratory Officers-in-Charge and their staff. A good example is a letter to the Dominion Entomological Laboratory, dated July 8, 1950, from the provincial Agricultural Representative at Eastend.

"Dear Sirs,

I am forwarding you a parcel containing a bottle with worms which were found in Eastend. These have been preserved in a formalin solution. These specimens were brought to me by Mr. H.S. Jones of Eastend. He reports that these worms came up from a hole by a gate post. The heads were sticking up about two inches. This location is close to a septic tank now in use and on account of not being emptied regularly, it has been overflowing very recently. There was a tiled drain which lead to a disposal area which has been plugged which runs past this gate. As health officials do not permit the use of these disposal areas in a town at the present time it is now not being used.

As these are horrible specimens and Mr. Jones is most interested as to what they might be.

Yours faithfully,"

The reply came from Dr. Mead of the Dominion Laboratory of Plant Pathology:

"Dear Sir,
The "worms" which you sent to the Entomological Laboratory are fungi called Stinkhorns, which grow from decaying wood. They are not edible.

Yours very truly,"

The first Scientific Information Officer was M.E. "Maury" Taylor who had been a member of the Dominion Entomological Laboratory staff since 1949, working on cutworm control. With the help of the other entomologists he established an insect identification service that soon became well known throughout the province. With the help of the plant pathologists, primarily Bob Ledingham, he managed to identify nearly all of the plant disease specimens as well. He was very effective in public relations and generated much goodwill. Right up until his retirement in 1980 he was a fine ambassador for the Research Station.

Some of the inquiries caused a chuckle, such as one from a compassionate lady at Dinsmore:

"Dear Sir,
Enclosed please find three bugs taped to this page. I have had them in an airtight jar for over a week trying to suffocate them but they don't seem to expire. I hope I am sending them to the correct department as would not want them to suffer needlessly. Could you please identify ..."

J.C. Boyer, Administrative Officer, 1961-1979.

Arlean E. McPherson, Librarian, 1966-1979.

M.E. Taylor, Scientific Information Officer, 1959-1980.

The new Laboratory also had a Building Engineer, Carl Schaeffler, who had been the foreman in charge of plumbing and other mechanical work during the construction period. Carl was "Carl" to everyone. Everyone, that is, except one staff member who insisted Carl address him as "Dr. ...", whereupon Carl insisted that henceforth Dr. X address him as "Mr. Building Engineer Schaeffler". Fifteen years after his retirement, his knowledge of the building is still called upon occasionally. With the new building came new greenhouses, eventually five in all, and in 1958 W.H. "Bill" Leonard was appointed greenhouseman, a position he held for the next 22 years until his "retirement" in 1980. His potting mix recipe (published as "Cornell mix as modified by W.H. Leonard of this Station ...") continues to be the best yet devised for growing healthy rapeseed plants. In 1960 the Station got its first photographer. He was Francis Dolezsar who was to remain in that position until he transferred to the Summerland Research Station in 1974.

After early teething troubles the new administration began to work smoothly. Hartley resigned in 1958 and he was succeeded by D.F. "Doug" Edwards. He stayed in the position for only three years to be followed in 1961 by J.C. "Cliff" Boyer, who transferred from Lethbridge. Boyer remained as the Administrative Officer at Saskatoon until his retirement in 1979, and was succeeded by R. J. "Ross" Peters.

J.E.R. Greenshields, Director, 1964-1979.

In 1964, Cormack returned to Lethbridge as Associate Director. His successor as Director at Saskatoon was J.E.R. Greenshields. A native of Semans, Saskatchewan, Ross Greenshields had worked at the Dominion Forage Crops Laboratory after his return from active service in World War II. He received his Masters degree under Bolton's direction and started a research program on sweetclover, later receiving a PhD from Iowa State University. In 1957 he transferred from Saskatoon to Ottawa to become the Head of the Grass, Legume and Pasture Research Unit, and in 1960 he became the Research Co-ordinator for Forage Crops. During his years as Director he moulded the Saskatoon Research Station into his ideal of what a research station should be. He strongly encouraged the oilseeds program and saw it become world famous. Ill health forced his early retirement in 1979 although he continued to be active. He was a strong supporter of the project to write the station history and it is sad that his death in 1983 did not let him see it completed.

Bella Ross working in the Dominion Entomological Laboratory office in the basement of the Field Husbandry Building (1939).

Modern equipment and pleasant surroundings help to create an efficient administration (Main office at the Saskatoon Research Station, 1985).

CHAPTER SEVEN

New Field Plot Facilities

In 1957, the staff of the newly amalgamated Science Service Laboratory had only limited facilities for carrying out field plot studies. The Plant Pathology and Forage Crops Sections still used the Preston Avenue plots as they had done in the Dominion Laboratory days. Most of the Entomology field work was done at sites away from Saskatoon although Stewart kept a "vegetable insect patch", roughly on the spot where the growth chamber building stands today.

Then in 1964, the Canada Department of Agriculture announced plans to close the PFRA Forest Nursery Station at Sutherland and was about to turn it over to the City of Saskatoon — for $1.00 — to be used as a park. No one at the Station knew what was proposed until Bolton and Knowles chanced to read about it in the July 30th Saskatoon "Star Phoenix". There was some quick thinking, hasty consultation, and a telephone call to Ottawa the next day by the Director. As a result, the proposed transfer was delayed and the Research Station was given a chance to stake a claim to what was potentially very valuable field plot land.

The total area of the nursery was about 162 ha. Some of this was already grassed and landscaped and used as a park, while another section was used for growing trees and shrubs for horticultural use. However, the larger and more desirable part was the nursery area for the annual production of 3.5 million seedling trees to be distributed to farmers for shelterbelt planting. Knowles and Boyer went down to City Hall and when the dust settled, the park and the horticultural area were turned over to the City and the Research Station obtained about 73 ha of good plot land.

Aerial view of the farm site in 1965.

Work starts on the new Farm building site (1966).

Clearing hedges at the Forestry Farm (December, 1966).

The concrete pad for the new equipment shed. The three granaries in the background are still on inventory 20 years later (1966).

In 1965, plans were drawn up for using the new land. A building site was chosen in the southeast corner adjacent to Rifle Range Road, and raised to prevent flooding. Three large machine sheds and three granaries were moved to the new yard. In the winter of 1966, a large steel building, which had just been erected at Preston Avenue, was moved across frozen fields to the new site. In 1985, the "farm" boasts several additional buildings, a well-equipped maintenance shop, and a newly paved yard.

Getting the building site organized was one thing; the caraganas were another. Thick caragana windbreak hedges had been planted in the early days of the Forest Nursery Station. About 45 m apart, they ran north and south, the length of the plot area. There were some Siberian elms, lilacs and maples also. The PFRA estimated that it

Digging the trench to the Preston Avenue irrigation plots (1965).

Aerial view showing the location of the Forestry Farm plots (arrows) northeast of the eastern edge of the University campus (lower left) (July, 1978).

Aerial view of the Forestry Farm plots (1981).

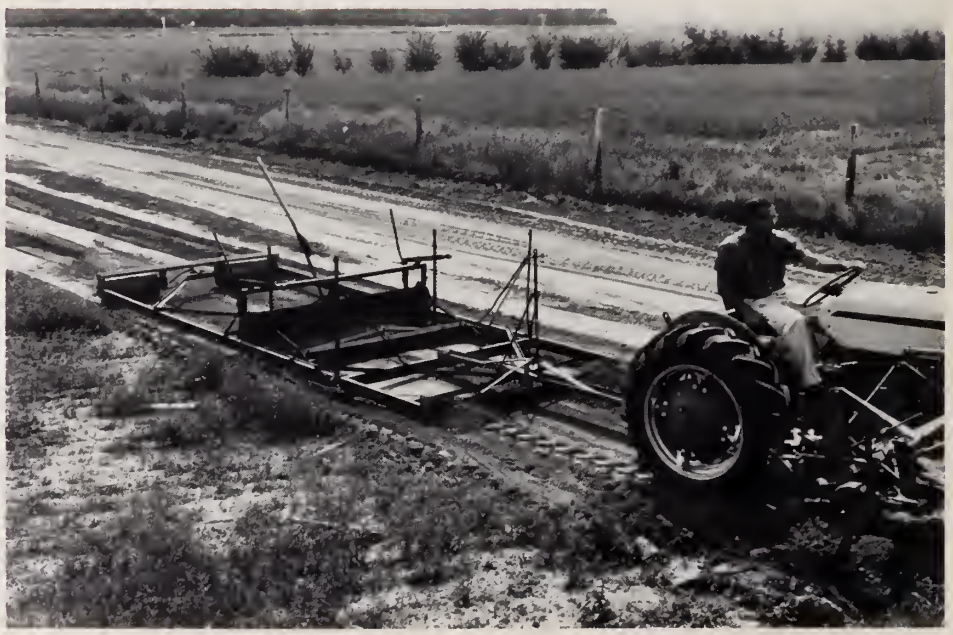
would cost $3.25 a metre to remove them. That worked out to quite a lot of money so Knowles and Ivan Bowman, the Farm Foreman, tackled the job themselves. Attempts were made to burn them in the fall but they seemed to thrive on that. They were eventually beaten by the front-end loader. After being tipped over, root and all, they were piled, allowed to dry, and then burned; the leftover roots were taken to the dump. In 1966 and 1967 about 5 km of caraganas and 3 km of Siberian elm, lilac and maples were taken out. It was later concluded that, compared to the other shrubs and trees, the caraganas had been relatively easy to remove!

The Station also acquired another 32 ha of land west of the main site. It also had numerous hedgerows and several dugouts. However, in 1973 this land was transferred to the City of Saskatoon in exchange for 32 ha immediately south of the building site. This consolidated the land holdings and got away from the tree belts and dugouts, but the exchange also brought a serious weed problem. The new land was thick with Canada thistle and wild oats, which are still a problem today. In 1986 another 50-ha block of land, immediately east of the farm site was purchased from the City of Saskatoon.

Research on irrigation started in 1964 when Lloyd Sonmor transferred from the Lethbridge Research Station. About 11 ha of land were leased from the University and there was a 5 ha site at Outlook, approximately 110 km south of Saskatoon. The University plots were located just east of Preston Avenue and north of the CPR tracks. The University pumped water from the South Saskatchewan River to a ditch which then carried it about 1.5 km northeast to the irrigated area. Originally the site had been levelled for flood irrigation but eventually a sprinkler system was set up instead. Cereals, oilseeds and forages were all tested under irrigation, but from 1975 onwards the main interest was in corn, both for silage and grain. In 1982, much of the area was lost to a new highway when the Circle Drive Bridge was constructed and this, together with Sonmor's retirement in 1983, resulted in a marked reduction in irrigation research.

Constructing the dugout at the Outlook irrigation plots (1965).

Lloyd Sonmor leveling the Outlook irrigation site (1965).



CHAPTER EIGHT

The Entomology Section, 1957-1981

In 1957, Entomology was by far the largest of the four sections, with 15 professional staff members: McDonald, Putnam, Riegert, Pickford, Burrage, Zacharuk, Taylor, Stewart, McMahon, Craig, Ewen, Fredeen, Brooks, Davis, and B.E. Brown, a toxicologist. The following year John F. Doane and R.L. Edwards joined the staff, and in 1959 Taylor became the Scientific Information Officer. McDonald was the Section Head, having been Officer-in-Charge of the Dominion Laboratory of Entomology since 1952. He first started work at Saskatoon with the Laboratory in 1933 as an Insect Pest Investigator. In the course of the next 40 years he worked on wireworm ecology, grasshopper surveys and cutworm control. In 1961, he became responsible for the grasshopper control program. From 1967 until his retirement in 1972 he was also the Assistant Director of the Research Station.

H. McDonald, Officer-in-Charge, Dominion Entomological Laboratory, 1952-1957; Head, Entomology Section, 1957-1967; Head, Insect Bionomics and Control Section, 1967-1972; Assistant Director, 1967-1972.

R.H. Burrage, Head, Insect Ecology Section, 1967-1972; Head, Entomology Section, 1972-1981.

The grasshopper team in 1957 consisted of Lloyd Putman, Paul Riegert and Roy Pickford. Putnam and Pickford continued the work on control using newly-developed insecticides. They both took part in the annual grasshopper survey, which was coordinated for many years by Riegert before he resigned and joined the staff of the University of Regina in 1968. All three also worked on different aspects of grasshopper biology and population dynamics. R.L. Edwards was part of the grasshopper program briefly from 1958 to 1961. R.L. "Bob" Randell joined the staff in 1964 to work on grasshopper demography, resigning in 1970 to join the Department of Biology at the University of Saskatchewan. In the late 1960's Al Ewen switched from forage crop insects to grasshoppers, carrying out research on the structure and function of their reproductive system.

The purpose of the grasshopper research was to determine the reasons for grasshopper outbreaks and to develop the capability of predicting their location and severity. Eventually, mathematical models were developed to predict hatching times, development rates and damage potential. The construction of these computer-based predictive models was the responsibility of Mukul K. Mukerji, who transferred to Saskatoon from the Ottawa Research Station in 1973, and Stuart Gage, who joined the staff in 1974; Gage resigned in 1977 and joined the staff of Michigan State University. The most recent member of the grasshopper team is Owen O. Olfert, who started in 1979.

In 1957, Zacharuk and Burrage were the two full-time staff members assigned to wireworms. Zacharuk, like so many other entomologists, had started as a summer student with the Dominion Entomological Laboratory in 1950. His research dealt with the biology of the click beetle, the adult stage of the prairie grain wireworm, considered to be the most important wireworm species in Western Canada. He resigned in 1963 to join the staff of the University of Regina.

Burrage joined the staff of the Dominion Entomological Laboratory in 1953, taking over Arnason's work on the biology and control of wireworms in Western Canada. He developed many innovative techniques in soil sampling, particularly the "brine-flotation" system which replaced the arduous task of sifting soil to separate out wireworm

L. Burgess, Associate Head, Entomology Section, 1972-1981.

larvae. He was also heavily involved with testing new insecticides for wireworm control. In 1967, when the Entomology Section was split into two, he became Head of the Insect Ecology Section (McDonald remained Head of the Insect Bionomics and Control Section). When the two sections were re-amalgamated in 1972 following McDonald's retirement, Burrage became the Head of the Entomology Section, remaining in this position until his retirement in 1982.

Doane joined the staff in 1958 and started research on the egg-laying behavior of adult wireworms. More recently, his work has focused on determining the chemical factors which attract wireworms to their food source. Norman S. Church started at the Station in 1963 and worked on several projects related to the reproductive physiology of beetles. At the time of his death in 1975, at the age of 46, he was investigating the regulation of feeding activity cycles of wireworms.

In 1957 three scientists, McMahon, Craig and Ewen, were assigned to forage crop insects. McMahon's work concentrated on pollinators, particularly the leafcutter bee. Craig also worked on pollinators, bumble bees especially, and on the control of alfalfa plant bugs and the sweetclover weevil. Ewen's first task was to investigate the physiological mechanisms involved in environmental adaptation of immigrant insect pests. From this he developed a comprehensive study of the physiology of reproduction in the alfalfa plant bug. Insect pests of vegetables were Stewart's responsibility. He took care of all garden insects, although root maggots took up most of his time until 1968. From then until his retirement in 1978, he was engaged in a mosquito control program.

With the advent of wet weather in 1938 through the early 1940's, mosquitoes made life miserable for everyone. However, the greatest danger was from Western Equine Encephalitis (WEE) in southern Saskatchewan. Studies in the USA had shown that several species of mosquitoes native to Saskatchewan were capable of transmitting WEE to horses, birds and occasionally to people.

The start of the South Saskatchewan River Development Project in 1959 and concern about possible effects of irrigation on mosquito populations in central Saskatchewan, were the stimuli for a multidisciplinary study on the ecology and epidemiology of WEE. This program started in 1962 and was sponsored by the Canada Department of Agriculture, the Department of National Health and Welfare, the Defence Research Board, the National Research Council of Canada, the newly opened Western College of Veterinary Medicine at the University of Saskatchewan and, to a lesser extent, the US Public Health Service. It was directed jointly by John McLintock at the Saskatoon Research Station and

Staff, Entomology Section, 1967. Front (left to right): R.H. Burrage, R.B. Lowe, L.G. Putnam, H. McDonald, J.J.R. McLintock, P.W. Riegert, A.B. Ewen, L. Burgess, K.S. McKinlay, M.E. Taylor. Center row: R.B. Woodford, G.S. Glen, F.J.H. Fredeen, H.A. McMahon, R.L. Randell, G.R.F. Davis, C.H. Craig, D.B. Noga, H.H. Weegar, W.W.A. Stewart, R. Pickford, N.S. Church, J.G. Saha. Back Row: J.F. Doane, C.G. Devlin, R.O. Vibert, E.G. Peters, W.K. Martin, M.N. MacLeod, F.T. Eves, J.E. Wiens, R.K. Allan, Jenise T. Saucier, Leslie A. Gadallah.

Bertha armyworm caterpillar.

Bertha armyworm moth.

J.G. Rempel of the Department of Biology at the University of Saskatchewan. The program was joined in 1972 by R.E. "Buck" Bellamy who worked on the overwintering of the vectors of the WEE virus until his death in 1977.

Between 1962 and 1967 the virus was isolated 82 times from mosquitoes. These isolations and the detection of antibodies in sentinel flocks of chickens in southeastern Saskatchewan showed that epidemics had occurred in southern Saskatchewan in 1963 and 1965. The surveys continued under McLintock's supervision until his retirement in 1977. He was succeeded by Lance Hayles, but with his resignation in 1982, the mosquito program at the Research Station came to an end.

The increase in rapeseed acreage, starting in the mid 1960's, brought with it a new set of entomological problems, including flea beetles. Work on flea beetles started in 1971 when Larry Burgess transferred from the mosquito program where he had spent the previous seven years working on mosquito physiology. His research is still devoted to unravelling the secrets of the behavior and life histories of flea beetles, particularly where and how they survive the long, cold Saskatchewan winter before appearing almost magically to devour newly emerged rapeseed and mustard seedlings in the spring.

The caterpillars of two insects, the diamondback moth and the bertha armyworm, were also soon identified as being potentially very destructive, particularly the latter (The bertha part comes not from an index of children's given names, but from part of an earlier scientific name — "*Barathra*".). There had been a serious bertha outbreak in 1956 and since that time several fairly heavy infestations had occurred, but there was nothing to predict the phenomenal outbreak of 1971.

The first reports of infested fields came in towards the end of July, and by August 3 the outbreak stretched from Nipawin to North Battleford. A few days later it was into Alberta and on August 9 infestations were reported in Manitoba. In the worst hit areas up to 95% of the rapeseed fields were infested. Where the worms numbered 250 to 500 per square metre, which was not uncommon, the plants appeared almost black and the sounds of the worms moving about and eating the pods could be heard quite clearly.

The only promising insecticide, Lannate, was not registered for use. Emergency registration was granted on August 5, and on August 6 the first shipment of 14 tonnes was airlifted from Houston, Texas, to Saskatoon by a Canadian Armed Forces Hercules transport aircraft. By nightfall it had all been used. Eventually about 400,000 ha were sprayed in the three Prairie Provinces, at a cost of about 3.3 million dollars. Even so, an estimated 14 million dollars worth of rapeseed was lost. The reduction in yield was kept to less than 10% in Saskatchewan, but the massive damage served as a vivid reminder of how quickly insect populations can build up. Little more than 10 years later, the lesson was to be relearned with the wheat midge.

One of the reasons why the 1971 outbreak came as such a surprise was that light traps were being used to monitor night-flying insects and bertha armyworm moths are not strongly attracted to light. After the 1971 outbreak it was obvious that a more reliable method of forecasting had to be developed. A.P. "Alf" Arthur transferred to Saskatoon from Belleville in 1972 and began work on the use of sex pheromones for monitoring bertha armyworm moths. These compounds had been identified from work at the Lethbridge Research Station and the National Research Council of Canada, Prairie Regional Laboratory in Saskatoon. With the development of a synthetic pheromone, traps were set up in 15 locations in Saskatchewan in 1978 and 1980. This monitoring system now provides an effective way of accurately estimating bertha armyworm moth populations, enabling both scientists and farmers to predict the need for control measures.

From the mid-1950's onward there was increasing concern about residue problems with the organochlorine insecticides that had once appeared the cure-all for insect pest problems. In 1954, residue studies had been started at Saskatoon with the appointment of J.B. Hartley, a toxicologist. He was followed in 1956 by Brian E. Brown, who left in 1958 on educational leave and transferred to London in 1960. When the staff moved into the new building in 1957 a well-equipped pesticide chemistry laboratory was established, as well as facilities for toxicological studies. The latter were conducted mainly by K.S. "Mac" McKinlay who joined the staff in 1961, retiring in 1982. Work on pesticide residues was expanded with the appointment of Jadu G. Saha in 1965. When Saha transferred to Ottawa in 1973 he was succeeded by Neil D. Westcott. Y.W. Lee joined the pesticide chemistry laboratory in 1967 and remained on staff until his retirement in 1981. An engineer, Ron J. Ford, joined the staff in 1970 to study methods of pesticide application and to develop spraying equipment.

With the new, highly sophisticated analytical methods it became evident that the organochlorine pesticides not only persisted in the immediate environment but were finding their way to areas far removed from the site of application. DDT, in particular, was showing up in low concentrations almost everywhere and was accumulating in harmful concentrations at the top of the food chain. Dieldrin, widely used for grasshopper and cutworm control, was showing up in meat and milk products through inadvertent contamination of forage and feed.

As the harmful effects of persistent chemicals became known, the Department of Agriculture took steps to reduce their use and ultimately to phase them out completely. Since the late 1960's most of the organochlorines have been replaced by less persistent and biodegradable insecticides such as dimethoate. However, nothing has been found to be an effective replacement for lindane as a seed treatment for wireworm control. It has been estimated recently that if the use of lindane were withdrawn without an effective replacement, wireworms would cause annual crop losses in the Prairie Provinces worth about 45 million dollars.

In addition to the environmental hazards of the persistent insecticides it also became evident that while net gains in crop production were generally impressive, crop loss was often still significant, even where insecticides were used. It has been estimated that 40 million dollars worth of crop was lost to grasshopper attacks in Saskatchewan in 1961, in spite of the extensive use of insecticides. Consequently, by the 1970's the entomology research program at Saskatoon was centered on an integrated pest management approach whereby there would be less reliance on pesticides alone and more emphasis on their safe and efficient use in combination with biological and cultural control measures. This was formalized in 1981 in a major reorganization which saw most of the entomologists become part of a new Section — Integrated Pest Management.

CHAPTER NINE

The Plant Pathology Section, 1957-1981

The second largest group in the new Science Service Laboratory was the Botany and Plant Pathology Section. The "Botany" part of the title was dropped in 1959 after the reorganization of the Department of Agriculture and formation of the Research Branch. In 1957 the staff members were Simmonds, Sallans, Ledingham, Tinline, Chinn, Russell and Mead. Later staff members were Rudolph W.L. Kaul (1962-1971), Carmine Noviello (1963-1964), J. Drew Smith (1965-1983), G. Allan Petrie (1965-), Howard Harding (1967-), John Dueck (1974-1981), L.J. Duczek (1977-) and Prithwi R. Verma (1977-). Simmonds continued to be in charge as Section Head until his retirement in 1962. He was followed by Sallans until he retired in 1966, when Tinline became Section Head.

There were four main programs in the section in 1957, Cereal Root Diseases, Soil Microbiology, Forage Crop Diseases, and Cereal Smuts, although the smut research was soon to be discontinued with Russell's retirement in 1961. The major thrust continued to be the control of common root rot of cereals with increasing emphasis on breeding and selecting for resistance to the disease. Differences in cultivar reaction had been noted in the 1930's but it was not until the early 1960's that an intensive effort to detect and utilize additional sources of resistance got underway. The project was initiated by Sallans and Tinline who showed that resistance was heritable, and later joined by Harding, working on wheat, and Duczek on barley. In the past 20 years, many thousands of lines have been carefully examined in attempts to find very highly resistant plants which could be used in breeding programs.

Unlike forages and oilseeds, there was no major cereal breeding program at the Saskatoon Research Station although Leigh Crowle was later to develop a fairly large utility or Triple-M wheat project. However, there was strong cooperation with the plant breeders at the Winnipeg and Swift Current Research Stations, and the Crop Science Department of the University of Saskatchewan. This cooperation continues to the present and is an integral part of the overall Research Branch program to develop new, disease-resistant cultivars of wheat and barley.

Chinn's research in soil microbiology was also directly related to common root rot, the aim being biological control. His work demonstrated that the number of spores of the fungus that caused the disease could be reduced by incorporating certain organic materials into the soil. This caused the normally dormant spores to germinate prematurely, and in the absence of suitable host plants they became vulnerable to attack by other soil fungi and bacteria. This work has been extended by Duczek, who is examining the role of predatory amoebae in killing spores and other fungal structures in the soil. While still not practical, biological control offers exciting future possibilities in integrated disease management programs.

B.J. Sallans, Head, Plant Pathology Section, 1962-1966.

R.D. Tinline, Head, Plant Pathology Section, 1966-1981; Head, Cereals Section, 1981-1984.

The use of chemical seed treatment for root rot control was explored over the years by various staff members. Protectant-type fungicides, such as the organic mercurial compounds, that became available after World War II were not effective in preventing infection of plants beyond the seedling stage. However, some of the newer chemicals that are transported within the plant were found, by Chinn and Verma, to show considerable promise. A number of these fungicides were tested, and largely as a result of this work, some of them may soon be registered for use in Canada.

When Kaul joined the staff in 1962 he was assigned to the Plant Pathology Section to carry out research on drought resistance in cereals. His research had an indirect bearing on the root rot program by virtue of the fact that root rot damage generally appeared most severe under drought conditions. He designed several ingenious pieces of equipment to determine the physiological factors causing plants to react differentially to drought stress. Wheat cultivars differed in their water potential and osmotic pressure but these factors were not consistently related to yield, indicating that other factors were also important. This work was discontinued at the Research Station when Kaul resigned in 1971.

The annual cereal disease surveys, with particular emphasis on common root rot, have continued to the present day. The survey was done mainly by Ledingham until his retirement in 1976, and since then it has been continued by Tinline, Harding and Duczek. It is a reflection on the genuine interest and good-natured tolerance of Saskatchewan farmers that in all those years of survey no one was ever asked to "move on", although Harding was once told by a crusty old gentleman in the Manor district that in all his 60 years of farming he had "never trusted a Government man".

A major contribution was a survey covering Manitoba, Saskatchewan and Alberta to determine yield loss in wheat from root rot. This was coordinated by Ledingham and it established that approximately 800,000 tonnes of wheat were lost to the disease annually. This study, published in 1973, was followed by a similar one on barley which showed that more than 1 million tonnes were lost each year.

There had always been close cooperation between the plant pathologists and the forage crop breeders. An example of this was the development of Beaver alfalfa, which is resistant to bacterial wilt. From the early 1950's until his retirement in 1964, Mead worked on ways to control black stem of alfalfa, a disease causing concern to the seed growers of northern Saskatchewan. His research involved chemical control using seed treatment fungicides as well as searching for disease resistance. Noviello was a staff member for only about a year before returning to his native Italy. However, during his short stay he pushed through plans for the construction of a culture room for growing fungi, a facility that is still very useful to the plant pathologists today.

Drew Smith joined the Plant Pathology Section in 1965 as a forage crops pathologist. He was already an acknowledged authority on turf grass diseases from his research in Britain and was fresh from a stint in New Zealand where he had worked in the then newly developing field of mycotoxins. His career in Saskatoon was marked by a number of significant contributions. He identified sources of resistance in bromegrass to a disease known as Selenophoma leaf spot, and cooperated with Knowles to incorporate this resistance into commerical cultivars. He worked extensively on the biology and control of "fairy rings" in lawns and on golf courses and made major contributions to unravelling the complex of fungi that cause snow mold. From his own selection program he developed a strain of bluegrass with particularly good all-round disease resistance and this was released as the cultivar Dormie in 1977. Like King 30 years previously, he continued a second career as an ordained Anglican minister following his "retirement" in 1984.

With the rapid increase in production of rapeseed in the 1960's there was increasing concern about potential disease problems with this crop. Since the late 1940's, T.C. Vanterpool of the Biology Department had been keeping an eye on diseases of oilseed crops in

The Plant Pathology Section, 1967. Seated (left to right), S.H.F. Chinn, R.D. Tinline, B.J. Sallans, J.E.R. Greenshields (Director), R.J. Ledingham. Standing (left to right) R.W.L. Kaul, Hilda L. Buckley, W.W. Reiter, R.G. Thompson, L.F. Gehl, J.I. Coroy, M.S. Bahrey, Rose Samways, J.D. Smith.

Black leg of rapeseed. Leaf lesions above, basal stem lesions below.

general. In 1965, one of his former students, Allan Petrie, joined the Research Station staff to conduct research on rapeseed diseases. The major disease problems to emerge were white rust, Sclerotinia stem rot and blackleg. While none of these diseases has been completely controlled, considerable progress has been made in this direction by breeding for resistance, using fungicides or changing agronomic practices.

The cultivar Tobin, released by the Research Station in 1981, was the first Polish rapeseed cultivar with resistance to white rust. Sclerotinia is a serious disease problem in both sunflowers and rapeseed. John Dueck started to work on this problem after his transfer to Saskatoon from Ottawa in 1974. When he moved to become Director of the Regina Research Station in 1981 the program was taken over by Verma who transferred from the cereal root rot project. While good genetic resistance to Sclerotinia has proven notoriously hard to find, work in cooperation with R.A.A. Morrall of the Biology Department at the University of Saskatchewan, has shown that timely fungicide sprays may offer an economical means of control.

The most serious cause for concern is the disease known as blackleg. Up until 1975 it had been regarded as a relatively insignificant disease, occurring on rapeseed, mustard and cruciferous weeds. Then in 1975 Petrie isolated a particularly aggressive race of the pathogen from badly infected fields in the Melfort/Star City area. This virulent race proved to be identical to the one that put an end to the fledgling rapeseed industry in Australia in the early 1970's. Fortunately, the environmental conditions in Western Canada were less favorable for the rapid spread of the disease. Fungicide seed treatments were identified, tested and recommended, to contain the disease within the affected regions in Saskatchewan. Despite these measures, the virulent strain had spread into Alberta by 1984 and to Manitoba by 1985. In the meantime, genetic resistance has been identified and is being incorporated into agronomically desirable cultivars.

During the 1970's, the objectives and goals of the Research Branch began to emphasize the research needs of particular commodity groups. Accordingly, the programs at the Research Station became increasingly crop-oriented. While the Plant Pathology Section remained as an administrative unit, individual scientists began to report to the Research Station goals relating to cereals, oilseeds or forage crops. Eventually this trend was formalized in a major reorganization in 1981. As a result, the forage crop pathologist became part of the Forage Crops Section and the two oilseeds pathologists became part of the Oilseeds Section. The remaining cereal pathologists formed the nucleus of the new Cereals Section and the Plant Pathology Section became history.

CHAPTER TEN

The Crops Section, 1957-1981 — Forages

J.L. Bolton, Officer-in-Charge, Dominion Forage Crops Laboratory, 1955-1957; Head, Forage Crops Section, 1957-1961; Head, Crops Section, 1961-1964.

In 1957 the smallest of the new Sections was Forage Crops with three staff members, J.L. "Lin" Bolton, R.P. Knowles, and R. Keith Downey. Bolton, who had become Officer-in-Charge of the Dominion Forage Crops Laboratory upon White's resignation to head the Field Husbandry Department at the University of Saskatchewan, was Section Head and was also responsible for the alfalfa program. Knowles was in charge of grass breeding and Downey, recently returned from the Lethbridge Research Station as a second alfalfa breeder, took over the small oilseeds program. In 1958, B.P. Goplen joined the staff as a sweetclover breeder following graduate work at the University of California.

In 1961 the section was renamed the Crops Section and by 1964 the professional staff had increased to five with the appointments of Lloyd G. Sonmor (1961) and W. Leigh Crowle (1964) who transferred from the Scott Experimental Station. Also in 1964, Bolton moved to Ottawa to become the Research Coordinator for Forage Crops, succeeding Greenshields who had just returned to Saskatoon as the Director. Knowles became the new Section Head, remaining in that position until 1976. The evolving activities of the section were later reflected in two further changes to the name of the Section; Plant Breeding (1971-1976) and Plant Breeding and Agronomy (1976-1981).

The grass breeding program at the Research Station has continued to have a profound effect on forage production in Western Canada as well as in the Northern Great Plains States of the USA. The bromegrass breeding program, which Knowles started in 1942, came to fruition in 1961 with the release of the cultivar Carlton. This was selected from local commercial northern types of bromegrass. Tests in Western Canada in 1963-64 showed that Carlton yielded 5% more hay than the commercial bromegrass then grown, and 25% more seed. Seed yield was particularly important since there was a substantial bromegrass seed industry, mainly in the Unity-Cut Knife district. Between 1947 and 1955 the average annual seed production was about 4500 tonnes, and much of this was exported to the USA. Carlton was a very successful cultivar, and in 1982 it still occupied about 80% of the Certified seed acreage in Saskatchewan.

In addition to the Canadian or "Northern" type of bromegrass there was the "Southern" type which appeared to be a better forage producer in the central states of the USA, i.e., Kansas, Nebraska and Iowa. At Saskatoon both types were about equal in hay production but the northern type yielded more seed. With an eye to increased sales to the USA, Knowles started a program to breed a southern type with increased seed yield. His efforts culminated in the release of Magna in 1968. In 1982, Magna was superseded by a further improved southern type cultivar, Signal, with seed yields better than either Magna or Carlton.

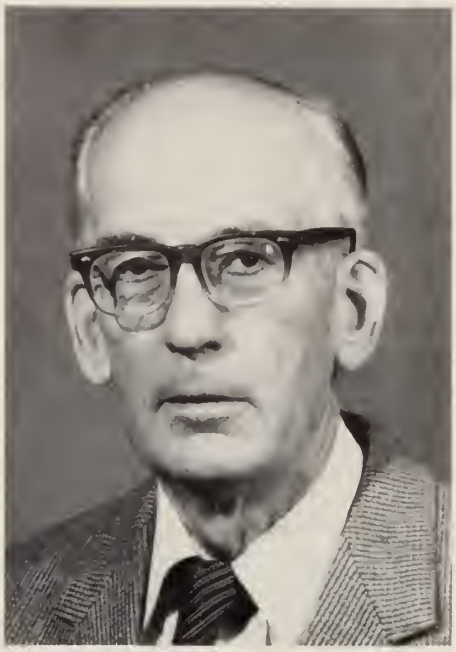
Other grasses also received attention. Intermediate wheatgrass was almost unknown as a forage crop until 1945 when reports came out of South Dakota and Nebraska on its high forage yields. Selections were made from some American material as well as introductions from the USSR, paying particular attention to improved seed yield and longevity. From this program the cultivar Chief was released in 1961. Chief never really caught on with farmers but in 1982 the Lands Branch of Saskatchewan Agriculture seeded about 2000 ha of this grass in their community pastures. In 1970, an improved cultivar of slender wheatgrass called Revenue was released by Crowle, who had started the selection work in 1960 while he was still at the Scott Experimental Farm.

When Goplen joined the staff in 1958, his first task was to develop a replacement for the low-coumarin, white-flowered sweetclover cultivar Cumino that was so relished by the blister beetles and jack rabbits. A backcross breeding program started in 1959 resulted in the release of the cultivar Polara in 1970. Also, in 1959, he started a breeding program to improve the yellow-flowered sweetclovers, which were becoming increasingly favored by farmers and ranchers. In 1970, a high-yielding, winter-hardy strain, well adapted to Western Canada, was licensed as the cultivar Yukon. The first low-coumarin, yellow-flowered sweetclover, Norgold was licensed in 1981, the result of a 22-year breeding program.

Goplen was also responsible for developing improved strains of other forage legumes. In 1981, the birdsfoot trefoil cultivar, Cree, was released after a 30-year program of selection. The improved sainfoin cultivar Melrose was released in 1969, the result of cooperative research between the Lethbridge, Melfort and Saskatoon Research Stations.

When Bolton moved to Ottawa in 1964, Goplen took over the alfalfa breeding program also. At that time the main thrust of this program was to improve disease resistance and increase winterhardiness. This continued until a major change in direction in 1970, when Goplen initiated a breeding program to develop cultivars which would not cause bloat in cattle being pastured on alfalfa.

In 1970, when the breeding program started, it was not known what caused the foaming in the animal's rumen that led to bloat. Some reports indicated that one particular protein, known as "Fraction I", was responsible for the foaming. If this were indeed the case, then theoretically it would be possible to select plants which contained only small amounts of Fraction I. However, R.E. "Ron" Howarth who joined the program in 1972, soon showed that in fact, all soluble proteins in alfalfa were responsible for foaming and thus for causing bloat. Consequently, many thousands of plants were tested in an attempt to select individuals which contained small amounts of soluble proteins. Other factors seemed to be involved also, such as the presence or absence of tannins and the structure of the plant cell wall, and it became apparent that the program would benefit considerably from the input of a plant physiologist. This was accomplished when Garry L. Lees joined the staff in 1976. Subsequently many of the original techniques were abandoned when it became apparent that they were not effective in detecting non-bloating strains of alfalfa. It now appears that the rate of digestion is the key to the selection of non-bloating strains and current selection methods are based on the direct measurement of the rate of digestion in the rumen of experimental animals.



R.P. Knowles, Head, Crops Section, 1964-1971; Head, Plant Breeding Section, 1971-1976.

In 1976, Knowles resigned as Section Head, and Goplen became Head of the newly named Plant Breeding and Agronomy Section. Previously the Agronomy component had been assigned to a separate Section of Crop Management (1971-1976) with Charlie H. Keys as Section Head. Other members of the Section were Crowle, Sonmor and Harry Ukrainetz who, like

Staff of the Crops Section, 1967. Seated (left to right) B.P. Goplen, R.K. Downey, Ann Low, R.P. Knowles, Gladys Hall (Secretary to the Director), J.J. Capcara, M. Bechyne. Standing (left to right) W.L. Kell, J.W. Cherkewich, Z.P. Kondra, A.N. Bell, R.I. Bowman, W.L. Crowle, J. Korol, L.G. Sonmor, J.L. Wilson, S.H. Pawlowski, N.C. Lawson, P. Poleschuk.

C.H. Keys, Head, Crop Management Section, 1971-1976.

Keys, had been transferred to Saskatoon from the Scott Experimental Station in 1971, although practically all of his experimental work on soil fertility is still carried out at Scott. Keys retired in 1976 and the remaining three section members were assimilated into the Plant Breeding and Agronomy Section. When the research programs were realigned in 1981, Smith and Craig transferred from the Plant Pathology and Entomology Sections, respectively. With the splitting off of Oilseeds as a separate section, the wheel came full circle and the Forage Crops Section was revived exactly 20 years after its demise in 1961.

Top right:
Philip Poleschuk with early plot harvesting equipment (late 1950's).

Centre right:
Ivan Bowman harvesting grass plots (late 1950's).

Bottom right:
Steer killed by pasture bloat. (Courtesy Lethbridge Research Station)

CHAPTER ELEVEN

The Crops Section 1957-1981 — Oilseeds

In 1957, only one staff member was involved with oilseeds research, and on a part-time basis at that. Downey had transferred from the Lethbridge Research Station the previous year as an alfalfa breeder. He was assigned the small rapeseed program since he had been familiar with it during his student days with the Dominion Laboratory of Forage Crops. The area under rapeseed production in the Prairies had increased from 1300 ha in 1943-44 to 32,400 ha in 1948-49. After dropping to a low of 200 ha in 1950-51 the area had increased steadily and in 1956-57 there were 142,000 ha of rapeseed in Western Canada.

Also in 1957, edible rapeseed oil was extracted for the first time in Canada. However, there was already some concern among nutritionists about the safety of rapeseed oil for human consumption. The main worry was its content of erucic acid, which seemed to have adverse effects on small animals in laboratory feeding trials. It became apparent that increased attention would have to be paid to analyzing rapeseed oil, not only for erucic acid, but for each of the other fatty acids also.

Early methods of analysis were cumbersome. They required the oil from about 0.5 kg of seed, plus several days of a technician's time. Fortunately, a new analytical technique known as Gas-Liquid-Chromatography (GLC) was being developed at the time. Scientists at the Prairie Regional Laboratory of the National Research Council of Canada on the University campus, using "homemade" instruments, soon refined the method to the point where a complete analysis could be done on a drop of oil in less than half an hour. This was a great boon to the breeders and it lead to the identification of the first "low erucic" plants of Argentine rapeseed (*Brassica napus*), in 1960. The following year the Research Station got its own GLC instrument and the first few low erucic plants of Polish rapeseed (*B. campestris*) were identified.

A second major advance was the development of the "half-seed" technique, whereby the oil from just half of a single seed could be analyzed accurately for its fatty acid content. The other half would still germinate and the plant could be grown to maturity if its oil was particularly desirable. With improved GLC instrumentation, progress was rapid and by 1964 agronomically acceptable, low erucic strains of *B. napus* had been developed.

However, as the breeding program expanded, the demands on the service laboratory in Ottawa, particularly for oil content analysis, became so great that often the results did not get back to Saskatoon until just before seeding time. Consequently, plans were made to set up analytical facilities at the Research Station. This was a major undertaking in view of the fact that the key instrument, a "wide-line nuclear magnetic resonance spectrometer", was extremely expensive. In fact, this would be the first such instrument to be purchased by the Department of Agriculture. It took quite a pitch by Greenshields and Downey to persuade the authorities in Ottawa, but they were successful and the "NMR" arrived at the Station in 1966. It required a room of its own and needed considerable care and attention, but it did provide very fast, accurate analyses on many thousands of samples until its replacement in 1979.

Another major step forward was the first Hege plot combine. Previous to this, plots had been harvested with a scythe or a sickle for threshing later. The labor involved in this process was enormous and it severely limited the number of plots that could be grown. When the Hege arrived in 1969 it was the first such unit in the Research Branch and it also had required considerable "justification". However, such was its success that today Hege combines are part of almost all plant breeding programs in the Research Branch.

The development of low erucic strains of rapeseed was now quickly picking up speed but it was still not certain that the new oil could, or would, be used in the edible oil industry. Accordingly,

Ann Low using the NMR, the first to be purchased by Agriculture Canada (1974).

arrangements were made to test it on a commercial scale. The Saskatchewan Wheat Pool did a test crushing of the Argentine strain SZ62-11, and the oil was evaluated under pilot plant conditions by Canada Packers, with very encouraging results. The new oil had significant processing advantages over regular rapeseed and soybean oils in the manufacture of salad and cooking oils. In 1968, SZ62-11 was released as the cultivar Oro. Unfortunately, at that time the market was swamped by a flood of surplus sunflower oil from the USSR. This effectively brought the low erucic program to a standstill and Oro was put on the back burner, at least temporarily.

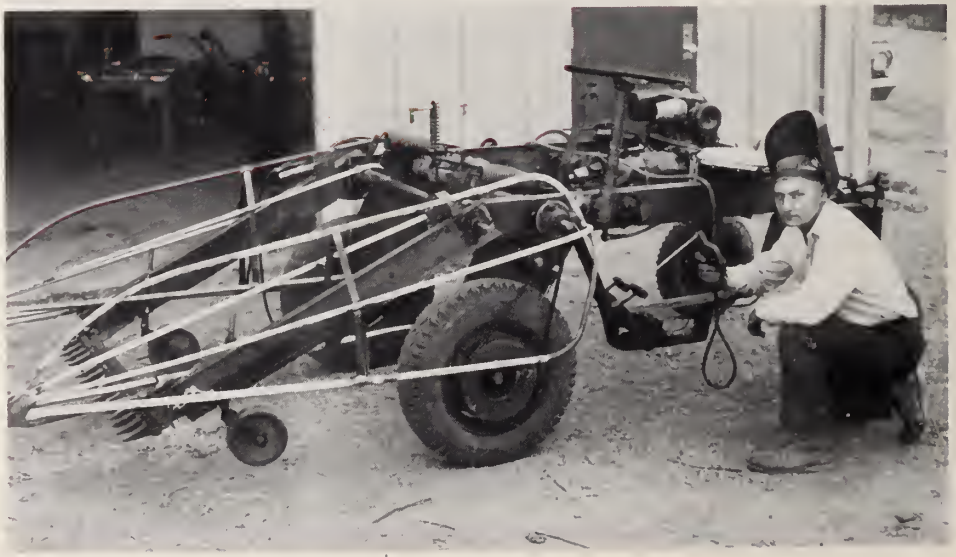
Then, in 1970, European nutritionists reported that high erucic acid rapeseed oil did indeed have adverse effects on young laboratory animals and suddenly low erucic oil became vital to the crop's survival. It was decided jointly by industry and government that Canadian rapeseed production should be converted as quickly as possible. Some seed of Oro was on hand to convert part of the crop, but only a small amount of seed of a low erucic *B. campestris* strain was available from Saskatoon. This material was increased in California's Imperial Valley in the winter of 1970-71 and in early 1971 it was licensed as the cultivar Span. Also included in that winter increase were 6 ha of an earlier-maturing, higher-yielding replacement for Oro, and this was licensed, also in 1971, as the cultivar Zephyr.

Within 2 years the 2-million ha crop was converted to low erucic acid cultivars without recourse to either legislation or regulation. There was a bit of a drawback in that Oro, Span and Zephyr yielded somewhat less than the old high erucic cultivars. However, 1973 saw the licensing of two new cultivars, Midas and Torch, which not only exceeded the old cultivars in seed yield and oil content but matured earlier also.

The conversion to low erucic cultivars essentially solved the nutritional problems with the oil. However, rapeseed normally contains sulphur-containing compounds called glucosinolates, which limit the use of the meal as a feed for poultry and pigs. Once again, initial progress was hampered by the lack of a suitable method of analysis and once again the scientists at the Prairie Regional Laboratory came up with the answer. By

The first Hege plot combine in the Research Branch system. Seated on the combine is R.K. Downey. In the dark suit is B.R. Stefansson, rapeseed breeder at the University of Manitoba (1969).

John Cherkewich and his custom-built plot swather (1974).



1965 the breeders at the Research Station were able to routinely screen their lines for glucosinolate content.

A breakthrough came in 1968 when a post-doctoral fellow, Jan Kryzmanski, found the low glucosinolate character in the Polish cultivar Bronowski. The Station immediately purchased 80 kg of Bronowski seed and air-freighted it from Poland. This was planted at Scott to provide a supply of seed for experimental processing and research into the nutritional properties of the meal. Bronowski was not agronomically suitable for production in Western Canada so the low glucosinolate character had to be transferred to better adapted breeding lines. This became the objective of the breeding programs at Saskatoon and at the University of Manitoba. By 1973 both groups had good "double low" (i.e., low erucic, low glucosinolate) lines under test. In the fall of 1973, all available data were reviewed and on the basis of a higher seed yield it was agreed that the University of Manitoba strain should be put forward for licensing. In the spring of 1974, the first double low Argentine rapeseed was released as the cultivar Tower.

Unfortunately, Tower, being a *B. napus* type, was too late for production in much of the northern rapeseed-producing area, and there was considerable pressure to produce a double low *B. campestris* cultivar as soon as possible. The desired plants were found in the progeny of a crossing program using different *Brassica* species. As an added bonus there were yellow seeded plants in this material. This was desirable since the yellow-seeded lines had thinner hulls and hence yielded a higher percentage of oil and meal. In 1978 the first double low *B. campestris* was licensed as the cultivar Candle. Candle yielded less than Torch and it also had reduced seedling vigor. However, these problems were overcome in its replacement cultivar Tobin, which was released in 1981. The following year the Station released a new double low *B. napus* cultivar, Westar, which yielded particularly well both in seed and oil production.

As these new cultivars rapidly took over most of the rapeseed growing area in Western Canada it was felt that a distinctive label should be attached to what was essentially a new and distinct product. Consequently in 1979, the term "canola" was coined to describe those products derived from double low cultivars of rapeseed. From humble beginnings, Canada's one-time "Cinderella crop" has become a high quality crop, second only in importance to wheat.

Dr. Downey and Dr. Greenshields (right) demonstrate new GLC equipment to Dr. V. Dragavstsev, a visiting Soviet geneticist (1972).

By 1981 the rapeseed crop had expanded to cover about 3.5 million ha, a 25-fold increase in about 25 years. As the crop increased in importance over this time period so did the number of staff working on its development and improvement. By 1960, Downey was working full-time on rapeseed breeding and in 1965 a second member, Norman C. Lawson, joined the staff. When he resigned in 1967 to take up a position at Macdonald College of McGill University, his place was taken by S.H. "Sid" Pawlowski who previously had been at the Lethbridge Research Station as a mustard breeder. Also in 1967, Gary R. Stringam joined the team as a cytogeneticist and initiated the research that has blossomed into the biotechnology program of today.

In 1970, D. Ian McGregor was appointed to provide the necessary chemistry input to the program. In 1976 he developed a rapid method for on-farm determination of erucic acid which was used widely in this country and abroad. In 1978, he patented a "go-anywhere" quick glucosinolate test kit which is still in common use. He also developed an industrial process for removing glucosinolates from mustard flour as well as a hail loss assessment guide which is presently being used by all rapeseed hail adjusters. Also in 1970,

a third breeder, A.J. "Al" Klassen, was recruited. Before his resignation in 1982 he, along with plant pathologist Allan Petrie, had played a major part in the development of the cultivars Tobin and Westar.

After an absence of many years, research on sunflowers was resumed at Saskatoon when Stewart J. Campbell was appointed in 1973 as a breeder and agronomist. In 1974 the cultivar Corona, developed jointly by the Saskatoon and Morden Research Stations, was licensed. Campbell resigned in 1979 and three years later the Saskatchewan Wheat Pool engaged a full-time sunflower breeder. Consequently, the sunflower work at Saskatoon was reduced to a simple evaluation program.

Research on mustard at the Saskatoon Research Station started in 1967 when Pawlowski transferred from the Lethbridge Research Station. While at Lethbridge he had developed the first pure breeding, yellow-seeded, Oriental mustard cultivar, licensed in 1967 as Lethbridge 22A. Following Pawlowski's resignation in 1974, the mustard program was assigned to D.L. "Don" Woods when he joined the staff in 1976. In that year, the high erucic yellow mustard cultivar Sabre was licensed. Low erucic acid strains of yellow mustard were developed also but the condiment industry preferred the product obtained from the normal erucic cultivars. In 1976, the first Canadian brown mustard cultivar was licensed under the name Blaze, and the following year an improved Oriental mustard with a higher yield and a sharper "bite" was released as the cultivar Domo.

With the realignment of the Station's administrative organization along crop commodity lines in 1981, Oilseeds became the largest of the five Sections. Downey became Section Head while still continuing to act as the Assistant Director of the Station. The Oilseeds Section continues to be recognized as a center of excellence in canola breeding and its successes have encouraged the infusion of research grants from outside agencies such as the Canola Council of Canada and Alberta's Farming for the Future program. These grants in their turn have allowed the development and expansion of new areas of research, which will enhance still further the reputation of the Research Station in oilseed breeding and agronomy world-wide.

Governor-General and Mrs. Schreyer visit the Research Station in 1979.

CHAPTER TWELVE

New Program Alignments and New Sections, 1981-1985

Since 1957 the Sections had been organized according to scientific discipline, i.e., Entomology, Plant Pathology, and Plant Breeding and Agronomy. During the 1970's the objectives and goals of the Research Branch became increasingly oriented towards individual crops or groups of crops. Scientists in different Sections began to report to these objectives, and in 1981 the trend became formalized with a reorganization of the Sections at the Saskatoon Research Station. Three of the new Sections were devoted to specific crops, i.e., Oilseeds, Forages, and Cereals. Most of the entomologists were retained in the Integrated Pest Management Section, and a fifth Section, Scientific Support, was established.

The objectives of the Oilseeds program are threefold: to improve management systems for rapeseed/canola production in northwestern Saskatchewan, and for mustard in the Dark Brown soil zone; to develop high-yielding cultivars of rapeseed/canola and mustard with improved chemical properties and good disease resistance; and to develop integrated methods for the control of insects in oilseed crops. To achieve these goals, the two oilseeds pathologists, Petrie and Verma, were transferred from the old Plant Pathology Section. Similarly, two entomologists, Arthur and Burgess, were assigned to the Oilseeds Section. Ukrainetz was also assigned to this Section although his research interests also encompassed cereal and forage crops. Also in 1981, two new staff members were appointed, Ginette Séguin-Swartz as a cytogeneticist and Gerhard F.W. Rakow as a rapeseed/canola breeder. In 1983 Kevin C. Falk was recruited as a third breeder and the following year David S. Hutcheson joined the staff, also as a canola breeder.

The objectives of the Forage Crops program are also threefold: to develop hardy, disease-resistant, bloat-safe cultivars of alfalfa; to develop improved cultivars of selected grasses for Western Canada; and to develop integrated methods for controlling insects in forage crops. This program consolidation involved the transfer of Smith from the Plant Pathology Section and Craig from Entomology. Goplen remained as Section Head, a position he had held since 1976 as Head of Plant Breeding and Agronomy. In 1984, Smith retired and his place was taken by Bruce D. Gossen. In 1985, Scott Wright joined the staff as the successor to Knowles who, while officially retiring in 1985, remains as an emeritus member of the program.

The remaining three plant pathologists, Tinline, Harding and Duczek formed the nucleus of the Cereals Section, with Crowle becoming the fourth member. Karen L. Bailey joined the staff in 1983. Tinline resigned as Section Head in 1984 and Harding took on this responsibility. The objectives of the Cereals program are to improve management systems for cereal production in northwestern Saskatchewan; to reduce losses caused by diseases, especially common root rot, with emphasis on the development of resistant lines of wheat and barley for the Prairies; and to develop very high-yielding cultivars of utility wheat of the Triple-M type.

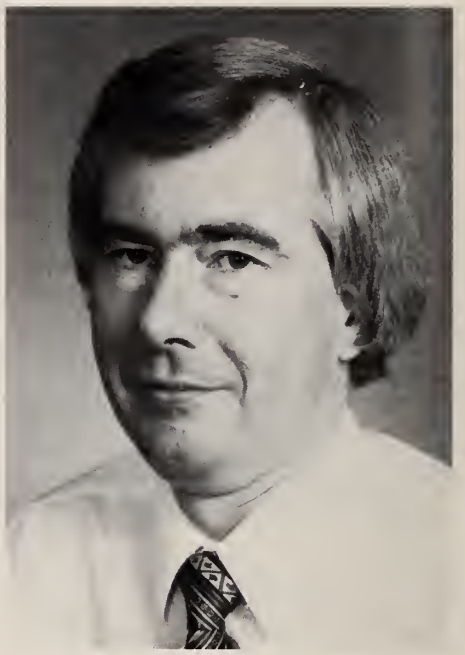
R.K. Downey, Acting Director 1979-1981; Assistant Director 1972-present; Head, Oilseeds Section 1981-present.

B.P. Goplen, Head, Plant Breeding and Agronomy Section 1976-1981; Head Forage Section 1981-present.

The Integrated Pest Management program deals with the development of control systems for problem insects (i.e., grasshoppers, wireworms, black flies and, more recently, the wheat midge) that are not specifically restricted to one commodity. A major objective of this program is the minimization of dependence on insecticides for the control of these pests. When Burrage retired in 1982, Doane became Section head. The other members of the section were the members of the former Entomology Section. Two additional staff members were recruited in 1983, R.H. "Bob" Elliott, a pesticides specialist, and C.F. "Chris" Hinks, a toxicologist. Martin A. Erlandson started in 1984 as an insect virologist. The newest member of the IPM team is Peter G. Mason (1985), who is continuing the black fly research.

With the reorganization in 1981 a new Section, Scientific Support was formed. Renamed "Scientific Services" in 1984, this section is designed to provide library, computer, statistics, photography and technology transfer services for the four research programs. Burgess was the original Section Head but stepped down in 1982 to be succeeded by Howarth. Present members of the Scientific Services Section are Diana M. Kichuk (Librarian), David T. Spurr (Statistician), Murray J. Bentham (Computer Systems Manager), Hilda K. Milne (Computer Programmer), Carl E. Lynn (Information Officer) and Ralph E. Underwood (Photographer).

J. F. Doane, Head, Integrated Pest Management Section 1982-present.



H. Harding, Head, Cereals Section 1984-present.

R.E. Howarth, Head, Research Services Section 1982-present.

R.J. Peters, Administrative Officer 1979-present.

The Saskatoon Research Station and its predecessors, the Dominion Entomological Laboratory, the Dominion Laboratory of Plant Pathology, and the Dominion Forage Crops Laboratory have played an important role in the development of agriculture in Saskatchewan and across the Prairies. The evidence for this resides in the accomplishments described in this history. However, it is not a definitive history of the development of entomology, plant pathology, and plant breeding and agronomy under the auspices of the Federal Department of Agriculture on the University of Saskatchewan campus. Subjects and anecdotes have been chosen to give a flavor of the times. Many accomplishments have been excluded but only because of space limitations.

Many scientists have been mentioned by name throughout the history. These were the ones who identified the problems, initiated the research, analyzed the results and saw to it that the new information found its way back to the farmers. However, it was the support staff that made it all work. The unsung heroes are the technicians, plotmen, secretaries, clerks, mechanics, librarians, maintenance engineers, stenographers, dishwashers, carpenters, greenhousemen, summer students and many others. Well over 200 names, past and present, are listed in Appendix B; perhaps some have been missed inadvertently. Their duties were often tedious, physically demanding, repetitive and sometimes frustrating, but always important. Without this kind of support the Saskatoon Research Station would not have achieved what it has and it would not have the recognition and support it now enjoys. The history salutes you!

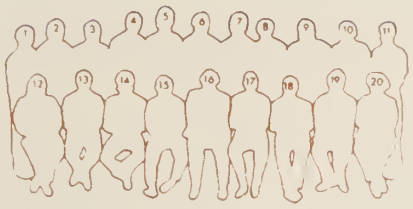
Great progress has been made in many areas but sometimes an observer may be forgiven for thinking that "plus ça change, plus ça reste même" — the more things change, the more they remain the same. In 1917, Cameron came to Saskatoon to tackle black flies; in 1985 the black fly outbreak in northeastern Saskatchewan was one of the worst on record. In 1919, Fraser came out west to help solve the rust problem; in 1985, stem rust was the biggest disease problem threatening winter wheat in southeastern Saskatchewan. Insects and diseases are never defeated. Rather, they are for the most part kept under an acceptable level of control. It is here that the entomologists and plant pathologists have made their contribution. Crop cultivars, production techniques and equipment have become obsolete as new cultivars, techniques and equipment are developed. This has been the contribution of the plant breeders and agronomists.

Agricultural research has made it possible for prairie farmers to produce more than their forefathers did, often under drought conditions which at times resemble the stricken Sahel region of Africa which attracted much of the world's attention in 1985. If, as seems likely, this demand for increased productivity continues, so will the demand for improved research. As the Research Branch of Agriculture Canada prepares to embark on its second century, the continuing importance of the Saskatoon Research Station to agricultural development in Saskatchewan and across the Prairies seems assured.

Above, and following pages. Staff, Saskatoon Research Station, 1985.

1. Ralph Underwood 2. Ross Peters 3. Jim Robb 4. Alan Kowbel 5. Ed Sacher 6. Tim Fahl 7. David Spurr 8. Sheldon Hood 9. Ken Storey 10. Don Lysyshyn 11. Harold Kinzel 12. Brian Lund 13. Doreen McNairn 14. Larry Weigel 15. Sandy Anderson 16. Diana Kichuk 17. Carl Lynn 18. Murray Bentham 19. Hilda Milne 20. Martje Campbell 21. Lorraine Braun 22. Theo Maatman 23. Pauline Evans 24. Al Ewen 25. Gail Girling 26. Sandra Senftner 27. Fran Taylor 28. Jim Hay 29. Gladys Hall 30. Angie O'Shea 31. Gail Charabin 32. Jan Korven-Stott 33. Angie Deck

Missing from photographs:
Karen Atkinson, Ken Bassendowski, Bob Elliott, Larry Mann, John Nerland, Jackie Nettleton, Theresa Novakowski, Palaniswamy Pachagounder, Susan Peters, Adele Rempel, Gordon Shoard, Scott Wright.



1. Murray Braun 2. Peter Kusters 3. Hartley Fredeen 4. Ron Ford 5. Keith Moore 6. Owen Olfert 7. Dwayne Lucyshyn 8. Neil Westcott 9. Bob Vibert 10. Glenn Gilkinson 11. Roy Lincoln 12. Sandra Northrup 13. Martin Erlandson 14. Randy Reichle 15. Mukul Mukerji 16. John Doane 17. Bill Martin 18. Chris Hinks 19. David Giffen 20. Elizabeth Cairns

1. Bruce Gossen 2. Lorne Duczek 3. Ron Howarth 4. Bill Reiter 5. Bob Knowles 6. Marvin Swartz 7. Walter Lasiuk 8. Ken Saretzky 9. Steve Dueck 10. Neil Suttill 11. John Korol 12. Bob Tinline 13. Bernie Goplen 14. Harvey Craig 15. Leigh Crowle 16. Garry Lees 17. Roncai Yang 18. Cheryl Duncan 19. Rita Kloster 20. Karen Bailey 21. Hilda Buckley 22. Lorie Jones-Flory 23. Stacey McCurdy 24. Debra Porter 25. Howard Harding

1. Darrell Tompkins 2. Alemayehu Tereffe 3. Getinet Alemaw 4. Yitbarek Semeane 5. Del McKenzie 6. Darryl Petersen 7. Allan Arnelien 8. Maurice Bahrey 9. Dave Hutcheson 10. Cliff Powlowski 11. Gerhard Rakow 12. Alf Arthur 13. Simon Barber 14. Don Rode 15. Ivan Bowman 16. Kevin Falk 17. Mark Forhan 18. Howard Love 19. George Wiens 20. David Kaminski 21. Harry Ukrainetz 22. Bud Weegar 23. Larry Burgess 24. Peter Mason 25. Allan Petrie 26. Don Woods 27. Philip Raney 28. David Noga 29. Ginette Séguin-Swartz 30. Laverne Lamport 31. Hung-Mei Kao 32. Prithwi Verma 33. Lori-Ann Kaminski 34. Keith Downey 35. John Capcara 36. Dorothy Burrage 37. Ian McGregor 38. Robert Wood 39. Ge Lanying 40. Wei Xiao 41. Joan Ulmer 42. Janet Coldwell 43. Sherry Gore 44. Yvonne Powell 45. Roger Beauregard

APPENDIX A

Student Thesis Projects Supervised by Members of the Dominion Forage Crops Laboratory and, subsequently, by Members of the Forage and Oilseeds Sections, Saskatoon Research Station

BELL, L. 1932 MSc. A germination study of reed canary grass.
WHITE, W.J. 1934 MSc. Factors which influence seed setting in alfalfa (*Medicago media*).
HOGG, P.G. 1937 MSc. Factors affecting the production of seed on herbage grasses under greenhouse conditions at Saskatoon.
ROWLES, C.A. 1938 MSc. Effects of fertilizers on alfalfa yields on wooded soils of Saskatchewan and related investigations on black, degraded black and gray soils.
BURNS, W.T. 1938 MSc. Correlation of some morphological characters in *Melilotus*.
PUTT, E.D. 1940 MSc. Sunflower breeding.
HEINRICHS, D.H. 1941
MSc. Regrassing studies in southwestern Saskatchewan.
KNOWLES, R.P. 1943 MSc. The role of insects, weather conditions and plant characters in alfalfa seed setting.
UNRAU, J. 1945 MSc. Inbreeding and hybridization in relation to sunflower improvement.
SCHALIN, E. 1947 MSc. The effect of fertilizers on the yield and composition of alfalfa on the podzolic soils of northeastern Saskatchewan.
SAVAGE, R.G. 1948 MSc. Moisture determinations in the comparative testing of forage crops for hay yield.
GREENSHIELDS, J.E.R. 1950
MSc. Polyembryony in alfalfa.
FORSBERG, D.E. 1951 MSc. The response of various forage crops to saline soils.
THAINE, R. 1952 MSc. The response of Russian wild rye grass to clipping frequency.
DOWNEY, R.K. 1952 MSc. The nature and inheritance of seed coat spotting in permeable strains of sweet clover (*Melilotus alba*).
TWAMLEY, B.E. 1953 PhD. Flower colour inheritance in diploid and tetraploid alfalfa.
HEARD, A.J. 1953 MSc. The effect of grazing on grassland in central Saskatchewan.
WILTON, A.C. 1954 MSc. The seed setting on tetraploid alsike clover.
GOPLEN, B.P. 1955 MSc. Sampling techniques and the inheritance of coumarin in sweet clover.
GROSS, A.T.H. 1955 MSc. *Elymus macounii* Vasey: It's origin and agronomic characteristics.
CROWLE, W.L. 1956 MSc. A heritability study on alfalfa.
BAENZIGER, H. 1957 MSc. The effect of interspecific hybridization on certain genetic ratios in sweet clover.
GHOSH, A.N. 1959 MSc. A study of emasculation techniques for perennial grasses.
ASHFORD, R. 1959 MSc. The effect of sulfur, nitrogen, fertilization and inoculation with *Rhizobium meliloti*, on the growth and chemical content of alfalfa and sweet clover in pot culture.
BAENZIGER, H. 1961
PhD. Supernumerary chromosomes in crested wheatgrass, their cytological behavior and breeding significance.
LINTON, J.H. 1961 MSc. Dicourmarol studies with farm livestock.
FRIDRIKSSON, S. 1961
PhD. Interspecific and intergeneric hybridization involving *Medicago* and related genera.
HARVEY, B.L. 1961 MSc. The inheritance of erucic acid content in rapeseed, (*Brassica napus* L. subspecies *oleifera* Metzg. Sinsk.).
BONIN, S.G. 1962 PhD. Heritability in reed canary grass with particular emphasis on seed shattering and its histological manifestations.
GHOSH, A.N. 1963 PhD. Cytogenetic investigations of a chlorophyll mutant in smooth bromegrass *Bromus inermis* (Leyss).
DORRELL, D.G. 1963 MSc. The inheritance of erucic acid content and other characteristics in *Brassica campestris* L.
PANKIW, P. 1963 PhD. The evaluation of normal and abnormal alfalfa flowers for pollination of honey bees.
FEDAK, G. 1965 MSc. A study of plant color in crested wheatgrass (*Agropyron cristatum* L. Gaertn.).
FOWLER, D.B. 1965 MSc. Lipid and morphological changes in developing seed of *Brassica napus* L.
KONDRA, Z.P. 1967 PhD. Some environmental effects on and genetics of the isothiocyanate and oxazolidinethione content of seed meal of *Brassica napus* L. and *B. campestris* L.
JUNK, R.J.G. 1969 MSc. Variability of grass quality as related to variety and location in Western Canada.
SONMOR, L.G. 1970. Some soil and engineering factors of significance in developing an irrigation research project.
KEHLER, W.P. 1970. The determination of moisture, protein, and oil in plant products by the use of nuclear magnetic resonance.
SALAM, M.A. 1973
PhD. Cyto-morphological and quality characteristics in the progeny of interspecific crosses between *Brassica napus* L. and *B. campestris* L.
GUTEK, L.H. 1973 MSc. Variation and heritability of soluble proteins in alfalfa.
COULMAN, B.E. 1973 MSc. Studies on the *in vitro* digestibility of crested wheatgrass strains.
PALAFOX de la BARREDA, A. 1975
MSc. The inheritance of erucic acid in *Brassica hirta* Moench.
VERA, C.L. 1981 MSc. Adverse effect of *Brassica* species on subsequent crops.
DALRYMPLE, E.J. 1982
MSc. Inheritance of tannins in birdsfoot trefoil (*Lotus corniculatus* L.) and tannin development in several forage legumes.
HUTCHESON, D.S. 1984
PhD. Performance of varietal hybrids and the relationship of seed size and colour with meal protein and crude fibre in *Brassica campestris* L.

APPENDIX B

Employee List
Employees who are now in full-time positions or who have worked for one year, or more, at the Saskatoon Research Station or its predecessors the Dominion Entomological Laboratory, Dominion Laboratory of Plant Pathology and Dominion Forage Crops Laboratory.

PROFESSIONAL SCIENTIFIC STAFF

Arnason, A.P.	1927 - 1952
Arrand, J.C.	1948 - 1957
Arthur, A.P.	1972 -
Atkinson, N.J.	1922 - 1927
Bailey, K.L.	1983 -
Bellamy, R.E.	1972 - 1977
Berg V.L.	1933 - 1939
Bolton, J.L.	1942 - 1964
Brooks, A.R.	1946 - 1962
Brown, B.E.	1956 - 1958
Burgess, L.	1964 -
Burrage, R.H.	1953 - 1982
Cameron, A.E.	1917 - 1920
Campbell, S.J.	1973 - 1979
Chinn, S.H.F.	1951 - 1978
Church, N.S.	1963 - 1975
Cormack, M.W.	1957 - 1964
Craig, C.H.	1949 -
Crowle, W.L.	1964 -
Davis, G.R.F.	1948 - 1985
Denyer, W.B.G.	1957 - 1965
Doane, J.F.	1958 -
Downey, R.K.	1956 -
Duczek, L.J.	1977 -
Dueck, J.	1974 - 1981
Edwards, R.L.	1958 - 1961
Eidt, D.C.	1951 - 1956
Elliott, R.H.	1983 -
Erlandson, M.A.	1984 -
Ewen, A.B.	1957 -
Falk, K.C.	1983 -
Ford, R.J.	1970 -
Fox, W.B.	1934 - 1951
Fraser, W.P.	1919 - 1925
Fredeen, F.J.H.	1947 - 1985
Fuller, R.A.	1946 - 1951
Gage, S.	1974 - 1977
Glen, R.	1928 - 1945
Goplen, B.P.	1958 -
Gossen, B.D.	1984 -
Greenshields, J.E.R.	1950 - 1957, 1964 - 1979
Handford, R.H.	1930 - 1932
Hardwick, D.F.	1944 - 1946
Harding, H.	1967 -
Hartley, J.B.	1954 - 1956
Hay, J.R.	1981 -
Hayles, L.B.	1977 - 1982
Hinks, C.F.	1983 -
Howarth, R.E.	1972 -
Hurst, R.R.	1924 - 1925
Hutcheson, D.S.	1984 -
Kaul, R.W.L.	1962 - 1971
Keys, C.H.	1971 - 1977
King, K.M.	1922 - 1946
Klassen, A.J.	1970 - 1982
Knowles, R.P.	1941 - 1985
Lawson, N.C.	1965 - 1967
Ledingham, R.J.	1938 - 1975
Lee, Y.W.	1967 - 1981
Mason, P.G.	1985 -
McDonald, H.	1935 - 1972
McGregor, D.I.	1970 -
McKinlay, K.S.	1961 - 1982
McLintock, J.J.R.	1965 - 1977
McMahon, H.A.	1936 - 1974
McMillan, E.	1925 - 1935
Mead, H.W.	1930 - 1964
Moore, H.W.	1944 - 1950
Mukerji, M.K.	1973 -
Newton, M.	1920 - 1921
Noviello, C.	1963 - 1964
Olfert, O.O.	1979 -
Paul, L.C.	1930 - 1944
Pawlowski, S.H.	1967 - 1974
Petrie G.A.	1965 -
Pickford, R.	1949 - 1975
Putnam, L.G.	1939 - 1978
Rakow, G.F.W.	1981 -
Randell, R.L.	1964 - 1970
Riegert, P.W.	1944 - 1968
Riley, C.G.	1957 - 1964
Russell, R.C.	1925 - 1961
Saha, J.G.	1965 - 1973
Salisbury, P.J.	1957 - 1960
Sallans, B.J.	1928 - 1967
Séguin-Swartz, G.	1981 -
Scott, G.A.	1925 - 1929
Simmonds, P.M.	1921 - 1962
Smith, J.D.	1965 - 1984
Sonmor, L.G.	1950 - 1983
Spurr, D.T.	1975 -
Stangeland, J.	1950 - 1951
Stevenson, T.M.	1931 - 1938
Stewart, W.W.A.	1944 - 1978
Stringam, G.R.	1967 - 1980
Taylor, M.E.	1950 - 1980
Timonin, M.I.	1961 - 1965
Tinline, R.D.	1947 -
Ukrainetz, H.	1971 -
Vaartaja, L. O.	1957 - 1960
Van Groenewoud, H.	1957 - 1965
Verma, P.R.	1977 -
Westcott, N.D.	1973 -
White, W.J.	1935 - 1956
Whitney, R.D.	1957 - 1965
Williamson, H.	1935 - 1946
Woods, D.L.	1976 -
Wright, S.B.M.	1985 -
Zacharuk, R.Y.	1950 - 1963
Zalasky, H.	1957 - 1965

ADMINISTRATIVE AND SUPPORT STAFF

Allan, R.K.	1950 - 1982
Anderson, A.K.	1981 -
Andrews, D.M.	1971 - 1972
Andrews, L.D.	1968 - 1969
Antill, R.B.	1965 - 1966
Arnelien, A.O.	1971 -
Atkinson, K.	1985 -
Bahrey, M.S.	1958 -
Baker, L.A.	1964 - 1967
Barton, D.L.	1978 - 1984
Bassendowski, K.A.	1982 -
Bates, J.	1964 - 1965
Beauregard, Y.M.	1980 -
Becvar, A.	1967 - 1976
Bell, A.N.	1967 - 1982
Bentham, M.J.	1976 -
Bhavaraju, B.	1967 - 1969
Black, T.A.	1976 - 1983
Boyer, J.C.	1961 - 1979
Boyes, J.W.	1933 - 1936
Bowman, R.I.	1951 -
Brandt, S.A.	1973 - 1979
Braun, L.	1974 -
Braun, M.P.	1973 -
Buckley, H.L.	1966 -
Burdock, B.J.	1953 - 1954
Campbell, M.	1982 -
Campbell, P.A.	1962 - 1965
Capcara, J.J.	1961 -
Carnie, B.L.	1957 - 1965
Charabin, G.M.	1983 -
Chatfield, E.J.	1954 - 1956
Chelack, W.S.	1956 - 1958
Chen, F.F.	1967 - 1975
Cherkewich, J.W.	1967 - 1978
Coroy, J.I.	1960 - 1977
Couturier, D.	1973 - 1974
Cowell, C.V.	1955 - 1978
Craig, W.K.	1978 - 1980
Dalgleish, H.D.	1931 - 1935
Davidson, P.	not known - 1959
Dean, C.A.	1981 - 1984
Devlin, C.G.	1946 - 1976
Dewar, E.	1977 - 1981
Dixon, E.J.	1965 - 1979
Dolezsar, F.	1960 - 1974
Dueck, S.J.	1974 -
Duncan, C.H.	1981 -
Edwards, D.F.	1958 - 1961
Ekstrand, G.E.	1967 - 1978
Ellard, G.M.	1941 - 1960
Epp, J.M.	1982 - 1984
Erker, L.A.	1974 - 1976
Evans, P.M.	1965 -
Eves, F.T.	1953 - 1978
Fahl, T.J.	1977 -
Farenik, W.K.	1975 - 1978
Fazakas, E.	1957 - 1959
Fenn, O.K.	1958 - 1965
Fesser, A.C.	1973 - 1981
Fidgett, R.E.	1960 - 1964
Fisher, V.M.C.	1959 - 1962
Gadallah, L.A.	1964 - 1967

Gehl, L.F.	1965 - 1968
Genest, B.C.	1976 - 1980
Gerein, D.J.	1981 - 1983
Gibson, A.	1972 - 1976
Giffen, D.W.	1982 -
Gilkinson, G.L.	1956 -
Girling, A.C.	1972 - 1975
Girling, G.M.	1980 -
Glen, G.S.	1960 - 1976
Glen, M.	1981 - 1983
Goorevitch, R.	1930 - 1938
Gordon, G.L.	1980 - 1981
Greenfield, V.	1969 - 1972
Gross, V.	1959 - 1960
Grybowski, M.J.	1947 - 1960
Gutek, L.H.	1970 - 1973
Hall, G.M.N.	1942 - 1985
Hanna, S.	1957 - 1970
Hartley, J.B.	1956 - 1958
Hendrickson, C.A.	1971 - 1974
Herman, M.S.	1961 - 1983
Hobson, M.A.	1950 - 1953
Holloway, A.E.J.	1974 - 1984
Hurley, R.N.	1942 - 1958
Ivanochko, M.	1958 - 1963
Jackson, L.J.	1978 - 1981
Jensen, E.	1961 - 1965
Jobb, C.P.	1983 - 1984
Johnson, C.	1975 - 1978
Joyce, J.W.	1938 - 1940
Kell, W.L.	1967 - 1977
Key, J.D.	1954 - 1963
Kichuk, D.M.	1983 -
Kimber, E.L.	1973 - 1974
Kloster, R.M.	1980 - 1985
Knowles, E.J.	1978 - 1981
Kohlman, J.J.	1965 - 1967
Korol, J.	1967 -
Kowbel, A.	1976 -
Kusters, P.M.	1983 -
Kroeger, P.G.	1967 - 1976
Lamont, S.M.	1970 - 1974
Laplante, T.E.	1966 - 1979
Lasiuk, W.	1968 -
Layng, G.	1962 - 1963
Lazeski, E.F.	1972 - 1984
Lein, D.G.	1972 - 1974
Leonard, A.	1961 - 1964
Leonard, W.H.	1958 - 1980
Lewis, P.A.	1981 - 1984
Lincoln, A.	1977 - 1980
Lincoln, R.	1980 - 1985
Low, A.	1958 - 1976
Lowe, R.B.	1946 - 1972
Lynn, C.E.	1981 -
MacLeod, M.N.	1946 - 1983
MacNeill, L.G.	1967 - 1968
Maatman, T.	1979 -
Mann, L.W.	1985 -
Martin, W.K.	1962 -
Matthews, C.	1959 - 1965
McCurdy, S.L.	1984 -
McKenzie, D.L.	1977 -
McNairn, D.C.	1979 -
McPherson, A.E.	1966 - 1979
McWade, J.W.	1964 - 1966
Melnyk, Z.	1962 - 1965
Metcalf, W.	1975 - 1977
Miller, J.E.A.	1977 - 1979
Millikin, W.	1950 - 1966
Milne, H.K.	1962 - 1966, 1968 -
Mochoruk, A.	1971 - 1975
Moffatt, L.E.	1981 - 1982
Moffatt, R.A.	1979 - 1981
Moore, K.C.	1979 -
Moore, T.W.	1978 - 1980
Morrison, G.G.	1950 - 1960
Muller, E.	1969 - 1973
Munro, L.J.	1966 - 1970
Newell, C.M.	1946 - 1948
Nerby, D.C.	1956 - 1966
Nerland, J.L.	1977 -
Nettleton, J.	1985 -
Newman, H.A.	1954 - 1964
Noga, D.B.	1966 -
Northrup, S.F.	1976 -
Novakowski, T.M.	1985 -
Noyce, F.E.	1962 - 1965
Ogilvie, J.E.	1954 - 1959
Olson, J.E.	1956 - 1957
O'Shea, A.F.	1984 -
Pachagounder, P.	1985 -
Pacholok, R.L.	1981 - 1982
Pawlin, G.S.	1959 - 1961
Peters, E.G.	1946 - 1975
Peters, R.J.	1972 -
Pirie, D.J.	1948 - 1951
Poleschuk, P.	1952 - 1975
Potter, M.	1959 - 1960
Powell, M.S.	1967 - 1969
Powlowski, C.J.	1973 -
Preston, B.	1974 - 1976
Quayle, A.	1974 - 1979
Radford, F.G.	1960 - 1965
Reichle, R.A.	1976 -
Reiter, W.W.	1965 -
Rempel, A.	1985 -
Richardson, M.M.	1972 - 1977
Rinas, D.	1975 - 1978
Robb, J.	1975 - 1985
Robertson, H.C.	1974 - 1975
Rode, D.A.	1980 -
Ross, I.	1936 - 1972
Sacher, E.R.	1978 -
Samels, D.C.	1968 - 1970
Samways, R.	1964 - 1971, 1976 - 1979
Saretzky, K.J.	1967 -
Saucier, J.T.	1961 - 1982
Schaeffler, C.	1957 - 1970
Schiller, K.A.	1978 - 1980
Schwab, H.S.	1965 - 1966
Senftner, S.D.	1980 -
Shaw, A.C.	1966 - 1981
Shier, C.A.	1961 - 1963
Shipman, R.	1976 - 1978
Shoard, G.A.H.	1985 -
Shore, C.	1930 - 1942
Solsten, B.J.	1980 - 1982
Storey, K.D.	1981 -
Stroeder, M.	1959 - 1962
Suttill, N.H.	1975 -
Taylor, F.M.	1984 - 1985
Taylor, R.K.	1947 - 1950
Thompson, R.G.	1965 - 1970
Thuns, H.	1961 - 1966
Trischuk, N.	1964 - 1978
Underwood, R.E.	1974 -
Vibert, R.O.	1950 -
Watson, E.J.	1976 - 1980
Weegar, H.H.	1954 -
Weigel, L.G.	1980 -
Wiens, J.E.	1967 - 1983
Wilson, J.L.	1964 - 1974
Wilson, M.	1938 - 1941
Wood, R.G.	1984 -
Woodford, R.B.	1965 - 1972
Worobey, B.L.	1971 - 1975
Wright, W.T.	1967 - 1977

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