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Dugout at work (PFRA-DREE photo). See article on page 12 about how to control evaporation in farm reservoirs.

Bassin de plein air (Photo ARAP-MEER). Voir l'article à la page 12 pour réduire l'évaporation des bassins.

CANADA AGRICULTURE

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Agriculture Canada

SEEDING PATTERNS FOR TAME PASTURES

M. R. KILCHER

A la Station de recherche de Swift Current, on a semé des graminées et des légumineuses adaptées, en lignes espacées de 15 à 90 cm. Au début, ce sont les lignes les plus serrées qui donnaient le meilleur rendement; toutefois, au cours des années, l'espacement optimal s'est accru. Les chercheurs ont aussi étudié les différents plans d'ensemencement pour les mélanges de graminées et de luzerne.

It all started some years ago with the casual observation that perennial forage plants in spaced nurseries grew larger and taller and produced more forage than the same type of plants in hay or pasture plots in rows 12 in. apart. Previous to the 12-in. stands, solid stands in 6-in. rows had been used. So, for a few years we seeded adapted grasses and legumes in rows with increasing 6-in. increments up to 36 in.

In a somewhat simplified manner, here's what happened to hay yield performance. The 6-in. stands did not produce as much as wider row stands. The 12-in. stands gave the largest yields for two years; the 18-in. stands took over first place for the next two or three years; finally, the 24-in. stands were on top during years five to seven inclusive. Eventually, perennial forages in even wider rows became the largest yielders.

But here's the rub! How many good yields do you sacrifice in the early years to obtain better performance in later years? After calculating the average annual yield from each stand over an increasing number of years, we favored the 18- to 24-in. spaced rows for a stand that will be down for 7 to 10 years.

At this point, we started testing grasses and alfalfa seeded in the same plots but in their own separate rows because mixed grass-legume hay is most often preferred. Here again we varied widths between rows, and we also seeded the two crops in alternate parallel rows, in crossed rows, and even as in-row mixes. What came out of this was that over the long haul, grass and alfalfa in 18- or 24-in. alternating rows gave average annual yields that were from 25 to 35% greater than mixed rows and 5 to 10% greater than crossed rows.

How this 25 to 35% average increase in yield was made up is important. In favorable or good moisture years, the increases were only 10% at the most. However, in dry years, when all yields were reduced, the increase in hay yields from the separated component stands often exceeded 200%. In addition, the increased yield was largely due to a higher proportion of the legume in the harvested hay.

Logically, the question arose: if this can be done for hay production, why can't the same apply for seeded pastures?

In 1973 we seeded replicated paddocks to Russian wild ryegrass and alfalfa in three different patterns:

(i) Grass and alfalfa as a mixture in rows spaced 18 in. apart.

(ii) Grass and alfalfa seeded in alternating parallel rows spaced 18 in. apart.

(iii) Grass and alfalfa seeded at right angles in rows spaced 36 in. apart. (Grass one direction — alfalfa crosswise)

They were grazed moderately in 1974 using cows with calves. In 1975 we stocked these paddocks at the rate of one cow unit (cow + calf) on each 2.2 ac. In the dry prairie regions of southwestern Saskatchewan, native grass produces so little that each cow unit needs from 15 to 25 ac to attain decent performance. The paddocks were grazed from May 12, 1975 to early August, at which time the cattle were removed. The following table shows the results obtained.

Pattern	Days of grazing	Av. daily gain per calf (lbs)	Live-weight calf gain (lbs/ac)
18-in. mix	83	2.45	91
18-in. alt. rows	70	2.60	88
36-in. cross	79	2.73	97

One year of grazing a perennial forage is insufficient to assess long-run performance. In 1975, the different stand patterns showed only slight differences in land unit production. Subsequent years will show us whether the alternate row or the cross-seeded row stands will outstrip the mixture stands as they have under a one-cut hay regime. ■

Mr. Kilcher is a specialist in pasture management at Agriculture Canada Research Station, Swift Current, Sask.

SEED PRODUCTION AND MARKETING IN CANADA

R. J. G. JUNK

With over 90 million acres of field crops under cultivation in Canada, growing and marketing of seed for crop production is a major undertaking. How does Agriculture Canada's Plant Products Division help ensure that farmers get the quality of seed they require?

The Seeds Act and Regulations give agricultural officers and inspectors of Plant Products Division authority to sample, analyze and grade seed offered for sale in Canada. Standards for germination and for freedom from weed seeds, other crop seeds, and seed borne disease are established under the Regulations.

In addition, the Division ensures that the Regulations are in keeping with Departmental and government programs and that they reflect changes in processing technology and consumer demand. All interested parties have an opportunity to present their views before any amendments are made to the Regulations.

The Seeds Act also provides authority for the licensing of varieties for sale in Canada. Following regional variety trials conducted at Agriculture Canada research stations, universities and colleges of agriculture, plant breeders recommend the varieties that merit licensing. Officials of Plant Products Division evaluate the data in support of the application and when all of the requirements have been met, issue the licence.

In addition, the Seeds Act provides the legislative authority under which The Canadian Seed Growers' Association sets minimum standards for seed production in the field and grants pedigree status.

Plant Products Division inspector draws a seed sample.

Un inspecteur de la Division des produits végétaux prélève un échantillon de semences.

Plant Products Division staff cooperate with the C.S.G.A. in seed certification. Officers of the Division, located at district offices across Canada, inspect seed crops in the field to determine if they are properly isolated from contaminating pollen, if the variety is true to type, and if the crop is free of certain weeds and other crops producing seed that is difficult to separate. The Association then issues Crop Certificates to acceptable fields.

After harvest, the seed is cleaned by the grower or by a processor to meet Canadian grade standards. A representative sample of the seed is analyzed to determine if the seed lot meets grade standards. An officer of the Division then applies official tags and seals to the bags.

Authority is delegated under the Seeds Regulations to qualified firms and persons permitting them to grade, tag, and seal Certified seed with official tags and seals. Authorized grower – processors may also sell Certified seed in bulk to farmers. These programs are monitored by Plant Products Division.

Canada Certified No. 1 and Canada Certified No. 2 are the grades generally available for crop produc-

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PRODUCTION ET COMMERCIALISATION DES SEMENCES AU CANADA

R. J. G. JUNK

Avec ses quelques 90 millions d'acres en culture, la production et la commercialisation canadienne de semences de grande culture représentent une opération considérable. Voyons brièvement ce que fait la Division des produits végétaux pour garantir aux agriculteurs la qualité des semences qu'ils désirent.

La Loi et le Règlement sur les semences habilitent les agents et inspecteurs agricoles de la Division des produits végétaux à prélever des échantillons, à analyser et à classer les semences mises en vente au Canada. La Division établit des normes relatives à la germination, à la teneur en graine de mauvaises herbes, de graines d'autres cultures et à la présence de maladies transmises par les semences.

De plus, elle veille à ce que le Règlement soit conforme aux programmes ministériels et gouvernementaux et à ce qu'il suive l'évolution des techniques de transformation et de la demande du consommateur. Avant d'apporter des modifications au Règlement, tous les intéressés ont l'occasion d'exprimer leur opinion.

La Loi sur les semences permet aussi l'homologation de variétés destinées à la vente au Canada. Une fois les essais régionaux de variétés effectués dans les stations de recherche du ministère de l'Agriculture, dans les universités et collèges d'agriculture, les sélectionneurs proposent les variétés méritant l'homologation. Les fonctionnaires de la Division des produits végétaux évaluent les données à l'appui et, quand toutes les conditions sont satisfaites, ils l'homologuent.

De plus, la Loi habilite l'Association des producteurs de semences du Canada à établir les normes de base de la production de semences en culture et à émettre les certificats de semences sélectionnées.

La Division des produits végétaux travaille à la certification des semences en étroite collaboration avec l'Association canadienne des producteurs de semences. Les agents de la Division postés aux bureaux régionaux inspectent les cultures porte-graines pour s'assurer qu'elles sont convenablement isolées de toute pollinisation étrangère, pour vérifier leur pureté variétable et veiller à ce que la culture soit exempte de certaines mauvaises herbes ainsi que d'autres cultures dont les graines sont difficiles à éliminer. L'Association délivre alors les certificats de culture pour les champs jugés acceptables.

Après la récolte, les producteurs ou les conditionneurs nettoyent les semences conformément aux normes de catégorie du Canada. Un échantillon représentatif des semences est analysé pour déterminer si le lot satisfait aux normes de catégorie. Un agent de la Division appose ensuite une étiquette et les plombs officiels sur les sacs.

Les échantillons arrivent à la Section des services de laboratoire de la Division des produits végétaux qui se charge de l'analyse

Farmers' samples arrive at the seed laboratory services section of Plant Products Division for analysis.

M. R. J. G. Junk est Chef de la Sous-section des projets relatifs aux semences, Division des produits végétaux, Direction de la production et des marchés.

tion. Both grades have the same genetic purity, but No. 1 assures a higher standard of germination and of mechanical purity. Buyers who choose Canada No. 1 or Canada No. 2 grades buy common seed of no particular variety. Foundation and Registered grades of seed are generally destined for further multiplication.

The tag is the buyer's guarantee that seed meets quality standards. Plant Products Division inspectors monitor seed at wholesale and retail levels to verify the grade and label, and to ensure that only licensed varieties are sold by variety name.

Seed of licensed varieties can be imported and sold in Canada if it meets minimum grade standards applied to domestic seed. Unlicensed varieties of most crops may be imported only for sowing by the importer, for multiplication and re-export, or for research purposes. Weed seeds or seeds of species not listed in the Seeds Regulations as a crop kind cannot be imported unless authorized by the Director of Plant Products Division.

Plant Products Division operates laboratories in major centers across Canada to analyze seed for grading and enforcement purposes, and to provide a seed testing service to the public. The laboratories at Montreal, Ottawa, Toronto, Winnipeg, and Edmonton are authorized to issue International Seed Testing Association (I.S.T.A.) certificates of analysis for seed to be exported. Seed for domestic use is tested in accordance with the methods and procedures prescribed under the authority of the Seeds Act. Commercial seed laboratories that have adequate facilities and trained staff may be authorized to issue results accepted for official purposes.

The bag is sealed with a tag.

Le sac est plombé et étiqueté.

In addition to purity and germination tests, Plant Products Division monitors varietal purity by growing seed samples in field plots in comparison with standard samples of the variety and by laboratory tests on seeds and seedlings.

The marketing of seed in Canada is in the hands of private seed companies, farmer-owned cooperatives, and seed growers themselves. Most seed firms in Canada are members of the Canadian Seed Trade Association. Plant Products Division gathers data and publishes a wide range of reports concerning the production and marketing of seed.

The Canadian Forage Seed Project (C.F.S.P.) encourages the production, distribution, and continued supply of improved forage crop varities developed by government institutions in Canada. A Coordinating Committee, representing the participating agencies, including plant breeders of Agriculture Canada and of universities, as well as provincial departments of agriculture, The Canadian Seed Growers' Association, and the Canadian Seed Trade Association, and the universities, directs the Project. Plant Products Division administers the C.F.S.P. and contracts with seed growers to multiply Breeder seed to Foundation level on behalf of the Project. Foundation seed is sold to members of the seed trade and to

Recherche des impuretés.

Searching for impurities.

Le Règlement sur les semences délègue aux établissements et aux personnes compétentes les pouvoirs de classer, étiqueter et plomber les semences certifiées que les producteurs – conditionneurs agréés peuvent aussi vendre en vrac aux agriculteurs. Ces programmes sont contrôlés par la Division des produits végétaux.

Les catégories Canada certifiée n° 1 et certifiée n° 2 sont les catégories généralement destinées à la production. Elles ont toutes deux la même pureté génétique, mais la catégorie n° 1 garantit un taux de germination plus élevé et de pureté mécanique. Les acheteurs qui choisissent les catégories Canada n° 1 ou Canada n° 2 achètent des semences commerciales sans mention particulière de variété. Les catégories de Fondation et Enregistrée sont en général destinées à une multiplication plus poussée.

L'étiquette garantit à l'acheteur que la semence est conforme aux normes de qualité. Nos inspecteurs vérifient le classement et l'étiquetage chez les grossistes et les détaillants afin que seules les variétés homologuées soient vendues sous un nom de variété.

On peut importer et vendre au Canada des semences de variétés homologuées à condition qu'elles satisfassent aux normes de catégorie de base attribuées aux semences nationales. Les variétés non homologuées de la plupart des cultures ne peuvent être importées que pour être semées par l'importateur, être multipliées et ré-exportées ou utilisées à des fins de recherche. Il est interdit d'importer des mauvaises herbes ou des semences d'espèces cultivées non mentionnées dans le Règlement sur les semences, à moins d'autorisation du Directeur de la Division des produits végétaux.

La Division dispose, dans les principaux centres du Canada, de laboratoires d'analyses de semences pour vérifier le classement et s'assurer que la Loi est respectée, et, pour fournir un service d'analyses de semences au public. Les laboratoires de Montréal, Ottawa, Toronto, Winnipeg et Edmonton sont habilités à émettre des certificats d'analyses de l'Association internationale des essais de semences, (AIES) des semences d'exportation. Celles qui sont destinées à l'utilisation intérieure subissent des essais conformément aux prescriptions de la Loi sur les semences. Les laboratoires commerciaux qui ont les installations nécessaires et un personnel formé peuvent être habilités à fournir des résultats acceptés pour fins officielles.

En plus des essais en laboratoire pour la pureté et la germination, la Division des produits végétaux contrôle la stabilité variétale en cultivant des échantillons en parcelles de culture, en les comparant à des échantillons types de la variété et par des épreuves en laboratoire pour les semences et les plantules.

La vente de semences au Canada se fait exclusivement par l'intermédiaire des marchands grainetiers privés, des coopératives d'agriculteurs et des multiplicateurs eux-mêmes.

seed growers for production of Certified seed.

The Organization for Economic Cooperation and Development (O.E.C.D.) has established Seed Schemes which provide an internationally adopted set of rules for certification and labelling to facilitate the multiplication and trading of seed between member countries. As the designated authority for the O.E.C.D. Seed Schemes in Canada, Plant Products Division approves multiplication of varieties from other countries; supervises technical conditions for multiplication; carries out field inspections; ensures that multiplications are carried out according to O.E.C.D. rules; issues O.E.C.D. certificates; labels and seals seed; and carries out post control tests to ensure varietal purity.

Plant Products Division personnel also represent Canada on other international organizations. Through participation in the Association of Official Seed Certifying Agencies minimum certification standards are established to facilitate movement of pedigreed seed between Canada and individual states of the United States of America. In the Association of Official Seed Analysts and the International Seed Testing Association, standardization of seed testing is achieved. Officers of the Division also take part in missions to develop foreign seed markets.

By working closely with all concerned, from plant breeders and seed growers to merchants, seed consumers, and provincial crop advisors, Plant Products Division is able to assure the farmer that he is getting seed that is accurately labeled and of the quality that he needs. ■

La plupart des entreprises canadiennes sont membres de l'Association canadienne des marchands grainetiers. La Division des produits végétaux recueille des données et publie une grande variété de rapports concernant la production et la vente de semences.

Le Plan canadien de multiplication des semences de plantes fourragères encourage la production, la distribution et l'approvisionnement régulier de variétés améliorées de cultures fourragères sélectionnées dans les établissements gouvernementaux. Le projet est dirigé par un comité de coordination représentant les organismes participants — y compris les sélectionneurs du ministère de l'Agriculture du Canada et de quelques universités — de même que les ministères provinciaux de l'agriculture, l'Association des producteurs de semences du Canada et l'Association canadienne des marchands grainetiers et les universités. La Division des produits végétaux supervise le programme et passe des contrats avec les producteurs pour la multiplication de semences de l'obtenteur jusqu'au stade Fondation. Les semences Fondation sont vendues aux membres de l'Association canadienne des marchands et aux multiplicateurs pour la production de semences certifiées.

L'organisation pour la coopération et le développement économique (OCDE) a établi des systèmes de production de semences déterminant un ensemble de règles de certification et d'étiquetage internationalement reconnues, en vertu desquelles les pays membres peuvent multiplier et vendre des semences. La Division des produits végétaux, organisme agréé au Canada par le plan de semences de l'OCDE, autorise la multiplication de variétés étrangères, en surveille l'aspect technique, effectue des inspections de culture, s'assure que les multiplications soient effectuées conformément aux règlements de l'OCDE, établit des certificats de l'OCDE, étiquette et plombe les semences et effectue des essais à postériori pour garantir la pureté variétale.

Des employés de la Division représentent le Canada auprès d'autres organismes internationaux. Par son affiliation à l'Organisme officiel de certification des semences, elle établit des normes minimales de certification harmonisant la vente de semences généalogiques entre le Canada et les états des Etats-Unis. L'Association des analystes officiels de semences et l'Association internationale d'essais de semences normalisent les modalités d'essais. Les fonctionnaires de la Division participent à des missions d'expansion des marchés de semences à l'étranger.

Grâce à une étroite collaboration avec tous les intéressés, à partir des sélectionneurs et producteurs jusqu'aux commerçants, consommateurs et conseillers agricoles provinciaux, la Division des produits végétaux garantit à l'agriculteur des semences correctement étiquetées et dont la qualité correspond à ses besoins. ■

IDENTIFYING STOLEN GRAIN

J. LOOMAN

Des méthodes courantes de phytosociologie et d'écologie ont été utilisées pour analyser des échantillons de blé dans les cas où le vol avait été possible, afin de déterminer les possibilités de similitude de deux ou de plusieurs échantillons. Les méthodes utilisées sont fondées sur l'hypothèse voulant que deux échantillons de blé ne peuvent être identiques sous tous leurs aspects à moins de représenter la même population.

The author and an R.C.M.P. constable examine grain samples under a microscope.

Grain thefts are difficult to prove, unless the culprit is caught red-handed, and most thefts have gone unpunished. Even if there is a suspect, which is rare, as well as a load of allegedly stolen grain, it remains to be proved beyond a reasonable doubt that the grain was actually stolen, and not the suspect's property.

How can this be proven? We suggested to the R.C.M.P. that standard phytosociological and ecological methods could be used to analyze wheat samples taken from the allegedly stolen grain, from the alleged "legitimate" source quoted by the suspect, and from the bins from which grain has been stolen.

This presents three possibilities. Firstly, the suspect's statement is true, and analysis of the samples shows that the allegedly stolen grain is identical to that in the suspect's bin. Secondly, the suspect's statement is false; analysis of the samples shows that the allegedly stolen grain is not identical to that of the source quoted by the suspect, but to a sample taken from a bin from which grain was stolen. Thirdly, the suspect's statement is false, but analyses show that the allegedly stolen grain is not identical to any of the samples taken by the R.C.-M.P. In each of these possibilities defence attorneys will insist on a degree of significance considered extreme in normal biometrics.

The methods used are based on the theory that no two samples of vegetation can be identical in every respect unless these samples represent the same population. In practice, absolute identity of two samples is improbable, even if the same population is sampled twice, or if two adjacent samples of vegetation are analyzed. For example, if two adjacents plots of 25 m² are placed in a pasture, both plots may have 25 species, but it is unlikely that the plots have more than 23 species in common. If the number of plants of each species is taken into consideration, the likelihood of finding the plots identical is reduced drastically.

Placing the plots at some distance of each other in the same pasture further reduces the likelihood of finding identical vegetation, and a still further reduction is achieved by placing the plots in different pastures. Comparisons can be made both qualitative, i.e., on the basis of species content, and quantitative, i.e., on the basis of the amounts of each species present. In quantitative work, different attributes of the vegetation can be used, e.g., number of plants per unit area, weight of plants, or vegetative cover. There is

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no reason why quantitative comparisons should not be extended to include attributes as leaf-size, height of plants, number of flowers per plant, and seed production, which are subject to the same influences prevailing in the environment as the attributes usually measured.

The feasibility of applying the phytosociological and ecological methods described to the identification of grain samples first occurred to me in 1973 when the R.C.M.P. inquired about the possibility of identifying wheat samples.

We know that wheat fields have, besides the wheat plants, a varying number of weedy plants. On an average, the wheat harvested in the Prairie Provinces contains about 3% dockage, and a large part of this dockage is weed seeds. I analyzed some test samples of wheat and confirmed that phytosociological methods could be applied, provided large enough quantities of weeds were present.

Although absolute similarity of two samples cannot be expected, we can calculate the probability of finding the observed similarity — or dissimilarity — by standard statistical methods. Because the use of triplicates gives a sensitivity seven times that of duplicates, samples taken by the R.C.M.P. had to be large enough to draw three sub-samples at random. Further, each of the sub-samples had to be large enough to contain a measurable quantity of weed seeds. Thus, in wheat with 0.1% of weed seeds, sub-samples must be at least 250 g if more than one species of weed is present, while samples of wheat with 2.5% weed seeds can be as small as 100 g per sub-sample. The total weight of the sub-samples should not exceed 10% of the sample from which it is drawn, and samples taken by the R.C.M.P. should normally be in the order of 5-10 kg, although in some instances smaller samples can suffice.

The analytical method used was simple. Each sub-sample was passed through a set of sieves, which separated the small seeds from the wheat. The large seeds were separated from the wheat by hand, and all weed seeds were identified, and weighed by species. This method thus gave several parameters for comparison: species content, total percentage weeds per sample, and weight percentage of each species.

Although two samples can be identical in any one of the parameters, the probability that they are identical by chance in two or more of the parameters is small, and can be computed. In qualitative comparisons, Chi^2 is calculated, which gives the probability of finding the similarity of species content observed. In quantitative comparisons, Student's *t* test for two means is used. Because this test applies to each of the parameters, and because the total probability for the sample is equal to the product of the separate probabilities, a precision of 5-7 decimals, or even more, can be reached. This precision is considered necessary to exclude all "reasonable doubt" as to the identity of the samples.

Thus far, 47 samples from 7 cases have been analyzed. In three of these cases the third possibility prevailed: no identical samples were found, and these cases were abandoned. In one case the suspect pleaded guilty after being confronted with the evidence of the analyses; in one case a conviction was obtained; one case is awaiting trial after a lengthy preliminary hearing; and the seventh case is up for preliminary hearing.

The defence in the case where a conviction was obtained pleaded reasonable doubt, and questioned the validity of the sampling procedure followed by the R.C.M.P. claiming that the samples were not necessarily "representative of the larger population from which they were taken". While establishing the validity of the sampling method recommended to the R.C.M.P. and of the analytical methods used, I was able to obtain an idea of the degree of contamination of wheat harvested, and of the prevalence as well as quantity of certain weeds.

The 47 samples were from southern Saskatchewan, and the results show that every year large quantities of weed seeds are harvested and transported. A total of 23 species occurred as contaminants in the samples, including some forage grasses. Only 13 of these species occurred in more than 10% of the samples, and only 6 species could be considered common (Table 1).

TABLE 1 – OCCURRENCE AND WEIGHT PERCENTAGES OF WEED SPECIES IN 47 WHEAT SAMPLES

Species	Occurrence	Av. % weight	Max. % weight
Wild oat	100	1.7	19.0
Wild buckwheat	96	.6	6.1
Green foxtail	77	.3	2.2
Goosefoot	68	.5	5.1
Stinkweed	66	.3	5.6
Flixweed	66	.1	1.5
Bluebur	41	+	.5
Cowcockle	30	+	.4
Flax	23	+	.1
Russian pigweed	21	+	+
Darnel	13	+	+
Russian thistle	10	+	+
Bulrush	10	+	.6

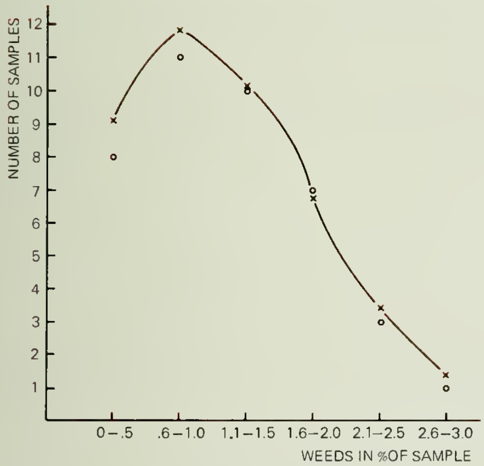


Figure 1 Distribution of weed contents: o = observed, x = Poisson

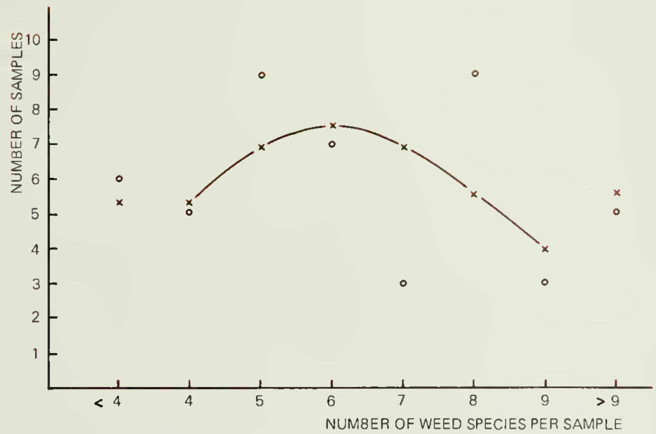


Figure 2 Distribution of number of species per sample: o = observed; x = Poisson

The range of weediness in the samples was very wide, ranging from a low of 0.1% to a high of 34%, with an average of 2.6%. Omitting the two extremes, the average drops to 2%. Averages and extremes of the more common species are given in Table 1.

On the assumption that the wheat samples seized by the R.C.M.P. — and hence the weed content — are representative of a very large population, the distribution of weed contents was checked against its Poisson distribution. The observed distribution is very close to expectance (Figure 1), and the samples may therefore be considered representative of the wheat harvested. This is further confirmed by the closeness of the average of 2.6% with the 3% weediness previously quoted. This means that approximately 80% of the wheat harvested in the Prairie Provinces may be expected to have less than 2% weed seeds, averaging about 0.9%, with the remainder containing more than 5% weed seeds.

The number of weed species per sample ranged from 3 to 16, with an average of about 6 species. Checking the distribution of number of species per sample against its Poisson distribution, it was found that deviations from expectance were not significant (Figure 2). Hence, about 60% of the wheat harvest contained 5 to 8 species of weeds.

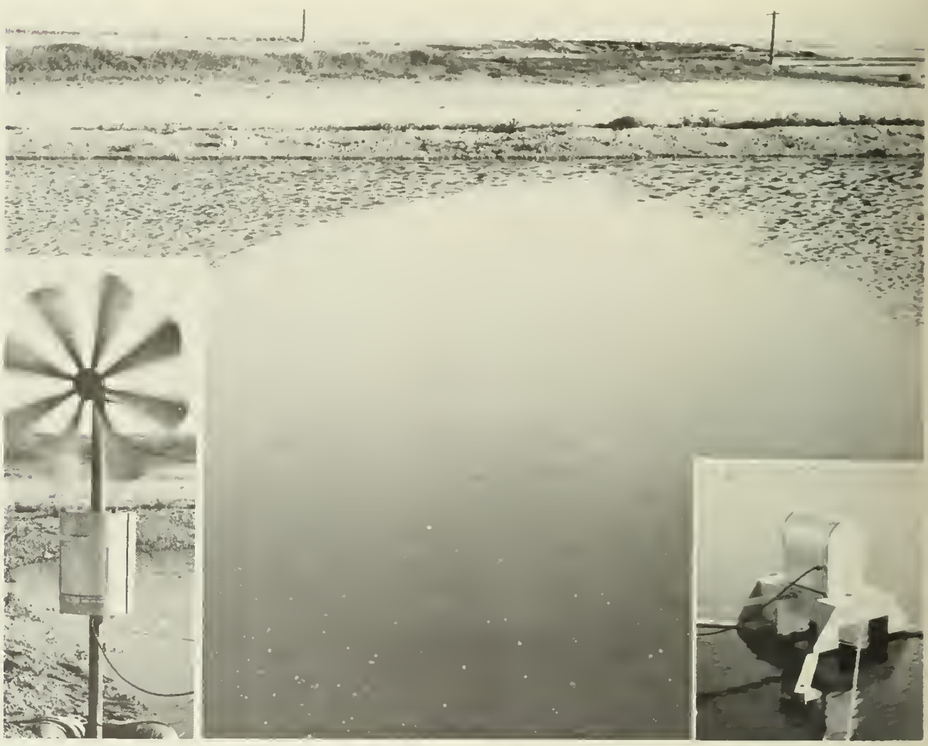
Statistical comparison of the weed populations showed that the weedy species formed 'weed communities'. Despite the influence of man, the species forming these communities, although drawn from a rather small species pool, were randomly distributed.

These results confirmed the validity of the sampling procedure used by the R.C.M.P., and the validity of the phytosociological and ecological methods used in analyzing the wheat samples. These analyses also show that weed control has been less effective than it should have been. Weed control can be improved by using better farming practices and more effective herbicides. ■

EVAPORATION CONTROL FOR FARM-SIZED RESERVOIRS

W. NICHOLAICHUK

Un des aspects de la conservation de l'eau fréquemment négligé, est le contrôle de l'évaporation. Depuis 1965, la Station de recherche de Swift Current étudie plusieurs méthodes pour réduire le taux d'évaporation des bassins en plein air.



Evaporation suppression by monomolecular films (center), wind-driven power supply (lower left), and dispensing unit (lower right).

Increases in human and livestock populations in the world will create ever greater demands upon fresh water supplies. In many areas, including the arid and semiarid regions of Western Canada, the available water supply is limited. In order to utilize the water resources to their maximum efficiency, water conservation becomes a necessity. One of the important aspects of conservation that is often neglected is the control of evaporation.

The rate of evaporation from water surfaces varies from location to location depending upon climatic conditions and weather elements. In southwest Saskatchewan, the evaporation from farm ponds and dugouts has been recorded to be as high as 90 cm per year. Since 1965, scientists at the Research Station, Swift Current have been studying possible methods of reducing evaporation rates from free water surfaces.

Two standard-size farm dugouts were constructed side by side; each was lined with polyethylene plastic, equipped with a stage water level recorder and provisions made for controlling the water levels. Water surface treatments to suppress evaporation were carried out at one of the dugouts while the other served as a check.

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We tried the following treatments:

(i) Application of a mixture of dotetra-, hexa- and octa-deconal powder (cetyl alcohol) for evaporation control using a wind-operated automatic powder dispenser.

(ii) The same treatment as in (i) except that both the check and treated dugouts were protected from wind by the use of 2.4 m high snow fence surrounding the reservoirs.

(iii) The same treatment as in (ii) except for an attempt to further reduce wind action on the treated dugout by floating several wood grids (12 m x 12 m) over the entire surface.

We found that monomolecular films (treatment i) reduced evaporation an average of 18.4% (Table 1). For short periods in which winds were minimal and film coverage extended over the entire dugout, the reduction of evaporation reached a high of 30%. However, in southwest Saskatchewan, the average wind speed of 11 km/h during the months of high evaporation makes this method of evaporation control somewhat restrictive. We found that the water saved cost $0.43/kl, which is five times higher than commercial water rates in Swift Current. These costs include material, maintenance, and capital costs.

TABLE 1 – EVAPORATION REDUCTION BY MONOMOLECULAR FILMS

Treatment	Evaporation reduction (%)	Test period (days)	Cost per kl (cents)	Average wind (km/h)
Cetyl alcohol	18	122	43	8
Cetyl alcohol, + windbreak	28	141	77	7
Cetyl alcohol + windbreak + grid to reduce wave action	34	189	62	7

Because wind appeared to be the main factor contributing to evaporation, a windbreak was erected around each dugout (treatment ii); the windspeed 0.6 m above the evaporating water surface was reduced 16.5%. This reduction in wind resulted in an average reduction in evaporation of 28% at a cost of $0.77/kl (Table 1). A further attempt to reduce wave action by means of a floating grid (treatment iii) improved the efficiency of the monomolecular film to 34% at a cost of $0.62/kl.

We also tested various types of evaporation suppression rafts as an alternative to monomolecular films. Ideally, you would like to cover the water surface without raising the temperature at the same time; the latter would increase the rate of evaporation. We evaluated the ability of rafts to withstand damage by wind action in the summer and frost action in the winter.

The rafts tested were made from styrofoam, styrospan, bead board, styrofoam panels equipped with an F-shaped suction edging, styrofoam panels covered with asphalt and protected on the edge with pvc tubing, styrofoam panels covered with stucco, and lightweight concrete panels. All panels (except the lightweight concrete and those covered with asphalt and stucco) were painted with white latex paint to protect the materials from deterioration resulting from sunlight exposure. Rafts constructed in 2.4 m x 2.4 m sections using either bead board, styrofoam, or styrospan were susceptible to frost cracks on the frozen water surface during winter and to wind damage during early spring when the ice layer on the dugout floated upwards. Damage to individual panels was about ten percent per year.

Styrofoam panels equipped with an F-shaped suction edging were not as susceptible to frost and wind damage in the winter and early spring, but were vulnerable to wind damage in the summer. Strong spring and summer winds lifted the panels from the water surface and blew them onto the nearby shore. Styrofoam panels covered with a layer of stucco were susceptible to frost cracks in the winter; more importantly, frost action caused the stucco to break loose and deteriorate rapidly, thus exposing the styrofoam to sun and wind damage.

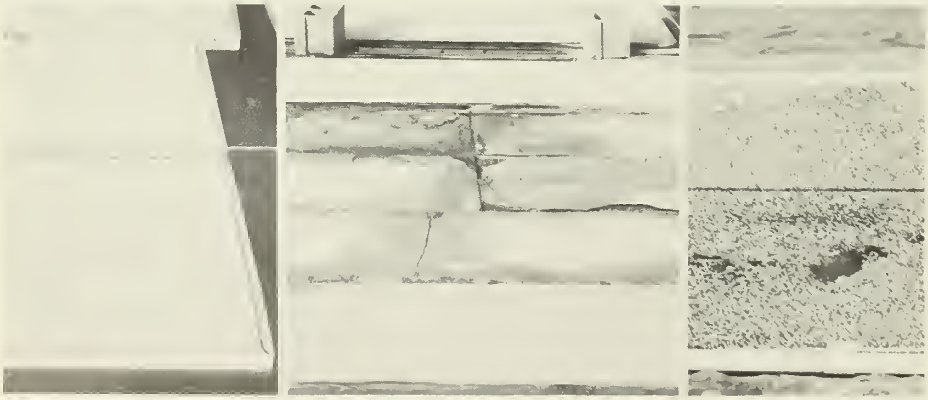
In our investigations, we found that styrofoam panels coated with asphalt and lightweight concrete were the most durable with respect to frost action and wind damage. The only problem encountered with the asphalt-coated panels was that the pvc tubing that protected the edges from abrasion broke loose from time to time and thus required maintenance.

Evaporation reduction by monomolecular film windbreaks and floating grid.

TABLE 2 – COST BENEFIT AND LIFE EXPECTANCY OF VARIOUS TYPES OF RAFTS FOR REDUCING EVAPORATION

Raft type	Estimated life (years)	Cost/kl (cents)	Remarks
Styrofoam, Styrospan, Bead board	10	57	Susceptible to frost cracks in the winter and wind damage during early spring
Styrofoam with F-shaped suction edging	10	65	Vulnerable to wind damage in the summer
Asphalt covered styrofoam	10	66	pvc tubing edge broke loose from time to time; not as susceptible to wind and frost damage
Stucco covered styrofoam	10	66	Stucco separated from styrofoam over winter
Lightweight concrete	20	44	Very durable but costs more initially

Configuration of rafts evaluated year round



Styrofoam panel with suction edging (left), stucco-covered panels (center), and asphalt-covered panels held by pvc tubing (right) used in the study.

We estimated that using styrofoam, bead board, and styrospan rafts cost $0.57/kl. The rafts were depreciated at a rate of 10% per year. Based on our experience with lightweight concrete rafts over a four-year period, we estimate that a life-span of 20 years can be expected. As a result, the cost of water saved is estimated to be $0.44/kl. Water saved using panels coated with asphalt and stucco will cost about $C.66/kl.

Generally, we found that the depth of ice formation beneath the various rafts was reduced 50% compared with areas not covered by any form of rafting material. If water is to be used from reservoirs completely covered with rafting materials that have insulating value, then more water will be available for use. This feature then becomes an added benefit apart from suppressing evaporation.

From this study, we concluded that rafts provided a good alternative to monomolecular films for evaporation suppression. The use of styrofoam type materials for rafts made the costs of water saved competitive with monomolecular films. The most economical type of raft was made from lightweight concrete, which saved water at a cost of $0.44/kl. This cost is still five times higher than the cost of water which can be obtained from an urban supply system, but the latter is usually not available to the farmer or rancher. ■

IMPROVING AGRICULTURAL MARKETS INFORMATION

C. D. CALDWELL and
BOB BELLINGHAM

Le Ministère de l'Agriculture du Canada exploite le CAMIS pour créer un système amélioré d'information sur les marchés agricoles. Il ne s'agit pas réellement d'un nouveau service mais d'une coordination et d'une amélioration de l'information déjà disponible.

Agriculture Canada is currently undertaking a Project to study the Canadian agricultural markets information system. Known as the Camis Project, its objective is to improve the content and availability of agricultural markets information to users. Our intention is not to develop another system, but to encourage the improvement and coordination of systems currently in operation throughout Canada.

To illustrate the potential of the project, consider information on cattle marketing: Statistics Canada has access to inventories of on-farm stocks of cattle; Agriculture Canada has data on public stockyard sales and cattle movements; the provinces could have data on the numerous small country auctions; information on imports and exports is available, but not easily accessible. If Camis can coordinate all this information, everyone will have a better knowledge of beef marketing.

Agriculture and food markets are affected by what is produced both in Canada and elsewhere in the world. Since the production of any one commodity relies on countless individual producer decisions, agricultural markets information is somewhat unique. It includes not only major market volumes, prices and trends, but also weather conditions, animals on feed, input costs, and input price trends, not to mention forecasts on all of these variables. Markets information can be current or historic, fact or forecast, narrative or graphic, regional, national or international.

Word processing equipment used to streamline production of marketing reports.

From a service point of view, market information is what the user says he needs. If this view is taken, there have to be some trade-offs. Information collection and dissemination is a costly business, and there is a point where the marginal benefit of having a certain piece of information is less than the cost of getting it. Similar trade-offs between accuracy of information and time must also be made.

The average family farm cannot afford the kind of comprehensive data collection and analysis required for modern farming decisions. Good markets information for producers, however, can help achieve a reliable food supply and a stable farm economy. This is in the interests of all Canadians.

Then too, government departments need markets information to develop policies and programs designed to ensure a stable supply of wholesome food. Moreover, markets information is needed to maintain and expand the export of agricultural products — for the benefit of the Canadian economy. Therefore, government must provide certain kinds of agricultural markets information as a public service.

The markets information service within Agriculture Canada serves

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clients both within and outside government with information vital to decision making. This is not to say that Agriculture Canada is the only supplier of markets information for agriculture. Indeed, many different agencies form a part of the overall agricultural information system. These include other federal agencies such as Statistics Canada, Industry, Trade and Commerce, and National Commissions, as well as provincial governments, marketing boards, producer associations, and processing and distribution companies.

The total system of agricultural markets information that we have in Canada today has grown in an adhoc fashion, by and large providing information as it became required. Each system of collection or dissemination was installed by the agency most critically in need of the information. The final product is a highly complex, essentially uncoordinated conglomerate stretching from coast to coast.

The systems have grown from clerical technology and are in the process of conversion to various forms of automated procedures. As this trend continues, the problems of duplication, response time, omission, and inflexibility are compounded. The entire food and agriculture system is thus working under a severe handicap.

Without exception all of the problem areas facing agriculture marketing today would benefit from better information. More importantly, it would allow us to forecast problems more accurately and to take preventive action to reduce their occurrence. For example, we would have better answers to such questions as: How much egg laying capacity really exists in Canada? Are there enough dairy cattle in Canada to produce sufficient milk for Canadians in 1980? What are the real costs of agricultural production? Why is a steer worth 35¢/lb. and steak selling for $2.00/lb.?

All of these questions deserve better answers than our market information can now provide. Preventive action before crises occur, based on sound information from a better system, in the long run could save millions of dollars. With some effort and at some cost, there is no doubt that better answers can be provided.

With the cooperation of federal departments, provincial governments, and agricultural organizations, the Camis Project operated by the Production and Marketing Branch, is looking into all commodity areas — dairy, grains and special crops, fruit and vegetable, poultry, and livestock.

The commodity and information specialists are studying what information is now available, and what information producers and others need. They are then analyzing the results of their surveys to identify problem areas. Finally, they are discussing their findings with the major agencies, to agree on what can be done to improve the flow of information to users.

The Camis Project has set up ongoing communication links, and is becoming the focal point for the reporting and resolution of market information problems and needs. All sectors are realizing that they need to cooperate with each other in order to have useful and complete information. Camis is one vehicle through which their goals might be achieved.

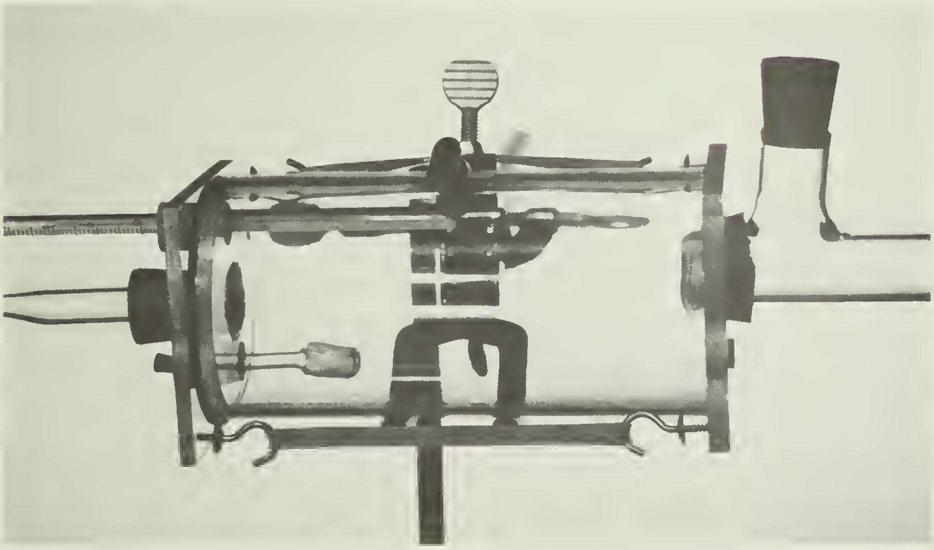
Organizations and individuals are invited to express their markets information needs by writing Bob Bellingham, Project Manager, Camis Project, Room 624, Sir John Carling Building, Ottawa, K1A 0C5. ■

Recorded livestock market reports are now available by telephone from all public stockyards and Ottawa.

INSECT SEX ATTRACTANTS

D. L. STRUBLE

En raison du danger d'un dérangement de l'écosystème par les insecticides, les scientifiques cherchent d'autres solutions. A la station de recherche de Lethbridge, ils étudient l'emploi de substances inoffensives telles que celles qu'utilisent les femelles d'insectes pour attirer les mâles lors de la saison d'accouplement.



An olfactometer

Every year, farmers lose part of their crops to insects. How can research help control these crop pests?

Insects have been controlled by various methods, but for the last three decades the most widely used technique has been application of insecticides. Although insecticides have enhanced agricultural productivity, they have also had unpredictable side effects, for example, environmental contamination with toxic residues, development of insecticide-resistant strains of insects, and destruction of non-target organisms. All of these disturb the natural balance of the ecosystem and this disturbance invites new, and perhaps more devastating, insect problems.

It is generally accepted that the use of insecticides should be minimized and that methods of insect control should be developed that either use insecticides more efficiently or do not require the use of toxic chemicals. At the Research Station at Lethbridge, we are investigating the use of innocuous chemicals such as those produced by female moths to attract males of the same species for mating. These chemicals, which Lepidoptera use for sexual communication, are called sex pheromones or sex attractants.

Several lepidopterous pests occur on the prairies; some of the common ones are the beet webworm, bertha armyworm, and clover, army, pale western, and redbacked cutworms. These pests attack a variety of crops and their attacks often come as a surprise because the larvae are very small and difficult to observe. The attacks are often undetected until damage to the crop is extensive. The only way of predicting the number of larvae in an area is by monitoring the population density of the moths. The moths are the only form that move to any extent or that are known to be attracted to light or chemical attractants.

Moth populations are monitored by using traps baited with ultraviolet light. Hundreds of insect species are attracted to the light traps and only a person trained in the identification of insects is capable of sorting out the economically important species. This trapping system is, therefore, not practical for general use.

Traps baited with chemicals that attract only one pest species per trap would be more useful because the identification of the moths would already be done. We are, therefore, looking for attractants that are specific for each of our major pest species.

We first had to find out whether the female moths of the pest species locate their mates by sex pheromones or whether both sexes are attracted to one food source and then, being in close proximity, locate each other visually. The presence of sex pheromones was detected in every lepidopterous species examined and it is now known that most moths communicate by the use of sex pheromones.

Pheromones, extracted from unmated female moths, were presented to male moths in an enclosed olfactometer system where their responses could be observed. Researchers, in the past, have had

Dr. D. L. Struble is an organic chemist at the Agriculture Canada Research Station, Lethbridge, Alta

Army cutworm males attempting to copulate as they enter a trap baited with a synthetic attractant.

difficulty in identifying the chemical composition of pheromones because these compounds are structurally complex and produced by the female in minute quantities.

One of the first lepidopterous sex pheromones chemically identified was the silkworm. Scientists in Europe isolated a few milligrams of the pheromone from over 500,000 unmated laboratory-reared female moths. The pest species that we are interest in are difficult to rear in the laboratory, so large numbers of females were not available for chemical identification. However, recent advances in chemical instrumentation and specialized microchemical techniques have made the identification of complex compounds feasible at the microgram level rather than at the milligram level.

Advances in insect nerve physiology have also made it possible to record the actual nerve impulses produced in antennae of the male moths when they are stimulated by the female pheromone or by closely related chemicals. This electroantennogram technique permits accurate and rapid testing of very minute quantities of possible attractants and female extracts. These advances have enabled some pheromone chemicals to be identified using about 1,000 times fewer moths.

We also tried to find sex attractants by synthesizing known pheromones and a large number of their chemical analogues. In 1969, about 15 lepidopterous pheromones were known and we used their chemical structures as the basis of a hypothetical chemical pattern from which to select the structures of other candidate attractants. We have now synthesized and purified over 100 candidate attractants on a milligram scale.

We had to test their attractancy to our pest species. We found that results from laboratory tests in the olfactometers differed from those obtained under actual field conditions. Moreover, the electroantennogram technique was not available to us. We, therefore, had to test all of the chemicals and some of their possible combinations in the field. This work was done with the help of two entomologists at this Research Station, Dr. G. E. Swailes and Mr. C. E. Lilly.

We placed traps baited with about 1 mg of the chemicals in the field. The synthetic attractant had to be released at a rate similar to that of the actual pheromone by the females. If the chemicals were released from the traps too rapidly or too slowly, the males would not be attracted, even by the actual pheromone. With this approach, we found combinations of chemicals that are good attractants for six pest species and, furthermore, we attracted about 70 other species to some degree; these synthetics provided leads to compounds that may be present in natural pheromones. During these field tests, we also discovered chemicals that will completely inhibit the attraction of some species. These attractant-inhibitors, which help interrupt normal chemical communication, may be useful in future pest-control programs.

A male clover cutworm moth attractant is one of the best that we have discovered. It consists of *cis*-11-hexadecen-1-yl acetate and *cis*-11-hexadecen-1-ol in a ratio of about 10:1. Either chemical alone is nonattractive. Field traps with 1 to 5 mg of this mixture attracted males for about five weeks. Of 40,000 males captured in 1974 and 1975, fewer than 20 males of other species were captured so the attractant is species-specific.

We can use this species-specific attractant to monitor populations of clover cutworm moths; as we determine attractants for other species, we can expand the monitoring program. If we can alert growers early to possible larval infestations, they can purchase recommended insecticides, inspect crops for larval damage at the correct time, and perhaps even follow agronomic practices that would control larval infestations without the use of insecticides.

Specific attractants and attractant-inhibitors may be useful for control of pests on small-acreage crops. There has been some success in controlling orchard pests with sex attractants rather than insecticides. More research is needed but the future for integrated insect control looks promising. ■

ROOT MAGGOTS, THEIR PREDATORS AND PARASITES

D. G. FINLAYSON

Les insecticides luttent contre les insectes nuisibles aux récoltes. Ces insecticides détruisent aussi les ennemis naturels des insectes nuisibles. L'auteur décrit les prédateurs et les parasites des larves qui ravagent les racines des crucifères cultivées. Parallèlement à la résistance des insectes aux insecticides, croît chez les chercheurs l'intérêt pour la lutte intégrée.

From early times, man has cultivated crops and selected special varieties for food production. However, certain pests became adapted to more intensive production conditions, and their attacks became more intense as well. Cabbage, onion and turnip maggots, and carrot rust fly populations increased and they became major pests. At one time, cultural, mechanical and biological practices were the only ways to control damage. Before insecticides were introduced, losses to root maggots often exceeded 75 percent.

It wasn't until the introduction of the organochlorine insecticides, especially the cyclodiene group (e.g., aldrin, dieldrin and heptachlor) about 1950, that growers of carrots, onions, and turnips could harvest crops without tunnels containing maggots. Yields increased dramatically and growers were reasonably content.

At that time little or no thought was given to the predators and parasites that earlier had given a degree of control over the complex of root maggots, mostly *Hylemya* species. The cyclodiene insecticides were the answer to all soil insect problems.

Dr. D. G. Finlayson in an entomologist at the Agriculture Canada Research Station, Vancouver, B.C.

Carabid beetles, predators of eggs of *Hylemya* spp. (actual size of beetles shown by black bar). Top row, left to right, *Bembidion lampros*, and *B. obscurellum*, bottom *Pterostichus melanarius* and *Harpalus affinis*.

One application at seeding controlled root maggots for the whole season. They were so persistent that much of the dosage applied one year remained for several years. Populations of parasites and predators decreased for they also were susceptible to cyclodienes. The bubble burst in the late 1950s when strains of root maggots resistant to the cyclodiene insecticides were reported from most areas where these pests were a problem.

Immediately, scientists began to develop rates and methods of application of other insecticides, especially the organophosphorus compounds and a new group, the carbamates. Neither group was as persistent as the cyclodienes, nor as effective. The result was that more toxic insecticides, which were more expensive, had to be applied more often, and the crop produced was subject to minor blemishes and sometimes reduced in yield. With this pattern established and with the possibility of the pests becoming resistant to the organophosphorus and carbamate insecticides, thoughts turned again towards predators and parasites, especially to the possibility of integrated control.

At Vancouver, we studied the four stages of *Hylemya* spp. — egg, larva or root maggot, pupa and adult fly. Predation is most likely to occur in the egg and the fly stages. Eggs are laid on or in the soil about the base of the plant. Once the egg hatches, the maggot burrows deeper into the soil and tunnels into the root after which the predator is unlikely to catch its prey unless the maggot kills the host plant and has to migrate to another plant. In seedling plants, the maggot must move and becomes susceptible to attack. On reaching maturity, the maggot leaves the host plant and forms a puparium in the soil. After about 14 days the fly emerges, works its way to the surface, and starts a new generation.

Predation on the eggs is probably the most effective means for decreasing the numbers of maggots. In experiments in the United Kingdom, four species of small carabid beetles, indigenous to Europe, are estimated to destroy about 90 percent of first generation cabbage root fly eggs. We found that of these *Bembidion lampros* (Hbst.) is common in the lower Fraser Valley of

British Columbia, and *Trechus obtuses* Er. present in small numbers; another, *B. quadrimaculatum oppositum* Say, is present in eastern Canada. The fourth, *T. quadristriatus* (Schrank), is apparently not found in Canada.

Several other carabid beetles, known to be predators of cabbage fly eggs in the United Kingdom, are present in Canada, such as: *Amara familiaris* (Duft.), *Clivina fossor* L., *Harpalus affinis* (F), and *Pterostichus melanarius* (Ill.). Unfortunately *C. fossor* is considered to be a pest of corn that attacks germinating seeds. Some of the larger species, including *H. affinis*, *H. rufipes* (found in eastern Canada), *P. melanarius*, and *Calathus* and *Amara* spp., have been reported to feed on strawberry fruits. Staphylinid beetles feed readily on cabbage fly eggs; *Aleochara bilineata* Gyll. and *A. bipustulata* (L.) are present in most areas where brassica crops are attacked by root maggots, and their larvae parasitize the fly puparia, which they use for overwintering.

In the laboratory, we observed that other carabid and staphylinid beetles feed readily on root maggots; the larger carabids, especially *Calathus fuscipes* (Gz.), will even crack open puparia. The larval stages of carabid and some staphylinid beetles are spent searching for food either in the soil or on the surface. They are predacious and cannibalistic, and it may well be that their food supply includes eggs, maggots, pupae, and even adult flies emerging from the puparia.

Predators of the flies are not so numerous. Spiders take some in webs spun in plants where the flies visit to lay eggs or obtain food. One predator known in Canada is an anthomyid fly, *Coenosia tigrina* (Fall.), first reported in Quebec attacking onion fly and later found in British Columbia associated with rutabagas.

The carrot rust fly: eggs, larvae or carrot maggots in carrot, puparia, female and male fly

The cabbage root fly: eggs, larvae or cabbage maggots in rutabaga, puparia, male and female fly.

Several species of wasps parasitize *Hylemya* spp. The most widespread and effective is the cynipid, *Trybliographa rapae* (Westw.), which searches out the host, even entering tunnels in the roots of plants to insert an egg in the maggot. Late third-instar maggots are seldom parasitized, probably because the cuticle is too tough for the ovipositor to penetrate. Unfortunately, if a larva of *Aleochara* enters a puparium parasitized by *T. rapae*, the beetle larva not only consumes the dipterous pupa but also the parasitic wasp larva. Other wasps taken in Canada from *Hylemya* spp. include two braconids, one identified as *Aphaereta muscae* Ashm. and the other as *Aphaereta* sp. near *auripes* (Prov.) both from *H. antiqua*. Puparia containing hymenopterous parasites are usually about half the size of normal puparia. Ichneumonid parasites are reported from Europe, but none of consequence has been reported from North America.

Other classes of parasites that reduce populations of root flies are mites, nematodes, and fungi. Instances of mites attacking both eggs and adults are recorded. Reports of nematode parasitism are few, the most significant being from Denmark where 7.5 to 16 per cent was recorded in the onion fly, *Hylemya antiqua*. Several species of fungi have been reported; *Empusa muscae* Cohn was responsible for heavy mortality of the onion fly in Ontario in 1959.

The seed-corn fly: eggs, larvae or seed-corn maggots on lima bean, puparia, female and male fly.

From the literature, it becomes apparent that of the predators and parasites associated with root maggots only a small number of carabid and staphylinid beetles and a cynipid wasp occupy the same areas as the root maggot complex and are capable of reducing the populations of *Hylemya* spp. in Canada. Over the past thirty years not enough attention has been given to integrated control. Even now many experiments are designed only to prevent damage to crops with little concern for non-target fauna.

Our collections and rearing studies revealed that Canada has the carabids and staphylinids necessary for integrated control but parasitic wasps are rare. In the laboratory, we found that *B. lampros* is susceptible to some of the organophosphorus compounds but is moderately tolerant to chlorfenvinphos and slightly less so to carbofuran. These insecticides are used to prevent maggot damage in brassica crops. The same pattern of results has been obtained in studies with the staphylinid parasitoid *A. bilineata*.

We are planning field programs to determine if integrated control schedules can be developed for root maggots in brassica crops, and if so, then we will consider control in onions and possibly carrots. ■

NEW ANTIGEN DETECTS ALEUTIAN DISEASE IN MINK

Le D[r] Hyun J. Cho de l'Institut de recherches vétérinaires du ministère fédéral de l'Agriculture, à Lethbridge (Alberta), a mis au point un antigène destiné à déceler la maladie de l'Aléoutien du vison. Cette virose coûte annuellement des millions de dollars aux éleveurs. Un accord a été conclu avec la société Connaught Laboratories Ltd. de Toronto pour la fabrication de l'antigène et sa distribution à l'échelle internationale.

Aleutian disease annually costs mink ranchers millions of dollars.

An antigen to detect Aleutian disease in mink has been developed by Dr. Hyun J. Cho, an Agriculture Canada veterinary scientist at the Animal Diseases Research Institute, Lethbridge, Alta.

This virus disease annually costs mink ranchers millions of dollars. It causes abortion, and postnatal and adult death in mink. The average mink litter is four, but the disease often reduces this average by as much as 40 to 50 percent. Even if an animal survives, it will produce a poor pelt.

Connaught Laboratories Ltd., of Toronto, recently undertook the manufacture and worldwide distribution of the antigen. Dr. Cho says Canadian mink breeders will be given priority for initial supplies of the antigen he developed. As supplies increase, it will be distributed internationally to provide mink breeders everywhere with the only commercial source of antigen.

Dr. Cho continues to act as a consultant to Connaught Laboratories, providing assurance that the commercial antigen is of high quality.

He first discovered the method for isolating the disease-causing virus while he was studying for his doctorate at the Ontario Veterinary College in Guelph under Professor D. G. Ingarm, the Associate Dean. Aided by grants from the Medical Research Council and the Canadian Mink Breeders' Association, Dr. Cho developed a rapid diagnostic procedure using the new antigen.

After graduation, Dr. Cho continued his research. Before releasing the antigen for commercial manufacture, he carried out extensive field tests. During this period the antigen showed significant benefits to mink herds in British Columbia, Alberta and Ontario. In some affected herds, 25 percent more young survived after one year of using the antigen diagnosis.

In November 1974, 4,360 blood samples from Alberta mink were tested and 1,009 positive cases of Aleutian mink disease were found — almost 25 percent! The affected mink were removed and 1,515 blood samples were retested in January 1975; only 26 cases of the disease, or less than 2 percent, were found. Almost a year later, in December 1975, another 2,197 blood samples were tested and only two positive cases were found.

Even better results were obtained in British Columbia. In 1,576 mink tested in November, 1974, 592 positive cases were identified. A retest early in 1976 found no infected animals. ■

WESTERN CANADA'S BEEKEEPING INDUSTRY

DONALD L. NELSON

Un chercheur de la Station de Beaverlodge fait le point sur l'apiculture florissante de l'Ouest canadien. Bien que les apiculteurs comptent beaucoup sur l'importation d'abeilles en paquets, des recherches se poursuivent sur les méthodes d'hivernage, le choix et l'élevage des reines et d'autres aspects de l'apiculture en vue de satisfaire à nos besoins.

Research is helping the Canadian beekeeping industry to expand. At Beaverlodge Mr. Nelson and Dr. Szabo are working to solve problems relating to: (i) honey production, (ii) wintering colonies indoors and outdoors, (iii) queen storage and behavior, (iv) queen selection and evaluation, and (v) disease, nutrition and comb building.

An increase in the number of colonies and an increase in honey production in the West has shifted the center of beekeeping from Ontario to Alberta over the last 15 years. In a 10-year average (1945-54), about 50% of Canada's 31.6 million pounds of honey was produced in Western Canada; in a 3-year average (1969-71), Western Canada produced 78% of the 51.6 million pounds of honey; and in 1974 Western Canada produced about 75% of Canada's 45.6 million pounds of honey.

The expansion of the beekeeping industry over the last 3 to 4 years has been spurred on by the rising price being paid for honey on the world market. The price has stabilized at about 40-45¢/lb wholesale. However, this expansion has brought with it the following problems.

Supply of package bees — Because of the increase in the number of colonies in Canada, the U.S.A. has been hard pressed at times to supply enough package bees to meet the new demand. In some of the areas where package bees are produced, poor spring weather has delayed deliveries as much as 2 to 3 weeks and in some cases has even limited the supply.

Increased prices of package bees — In the last 3 years, the price of package bees has increased threefold, to an all time high of $18 per package (delivered) in 1975.

Input costs — In addition to the cost of package bees, the price of lumber, wax foundation, fuel, and labor are all increasing costs to the beekeeper. These increases have almost wiped out any advantage gained by the higher honey prices.

In 1974, Canada imported 342,000 packages of honey bees; 93% of these were used to initiate colonies in Western Canada. Thus honey production in Canada has become primarily dependent on spring shipments of bees from the U.S.A. Because of the increased cost and uncertain supply of our present sources of bees, the Canadian beekeeping industry has started looking at alternative sources of queens and packages. Two promising solutions are wintering colonies in Canada to ensure our own supply of bees and obtaining bees and queens from several countries.

Wintering studies at Beaverlodge indicate that the timing and method of colony preparation and queen type are very important factors to ensure successful wintering of colonies. Selections are being made to obtain a bee that is better suited to Canadian conditions and to the

Hives in summer yard with good windbreak.

Mr. D. L. Nelson is Head, Apiculture Unit, Agriculture Canada Research Station, Beaverlodge, Alta.

TABLE 1 — HONEY PRODUCTION OF WORLD'S LARGEST HONEY PRODUCERS (MILLIONS OF POUNDS)

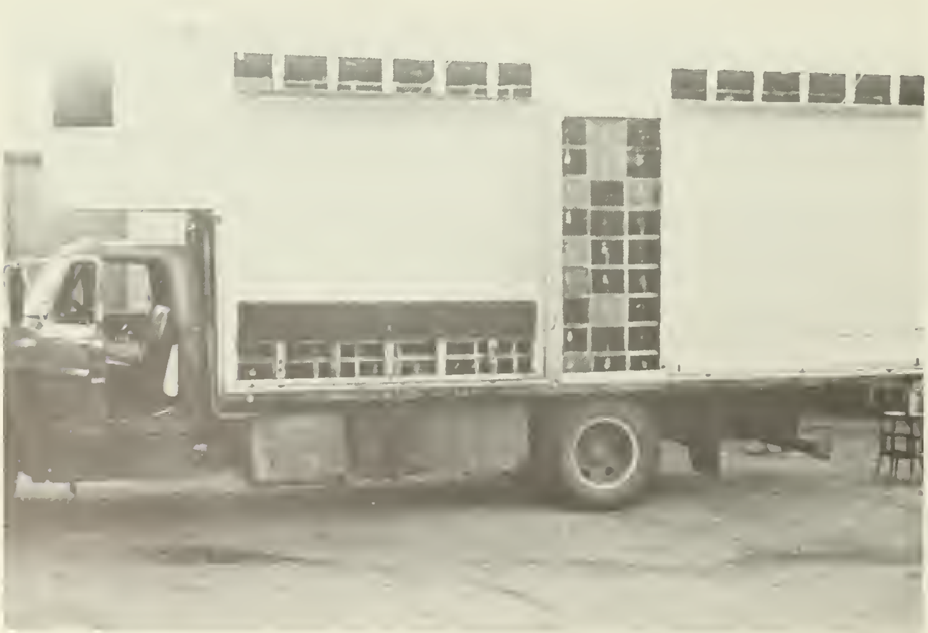
	1964-68	1971	1973	1974
U.S.A.	228.4	197.4	238.7	185
U.S.S.R.	221.5	237.0	246.5	*
Mexico	68.0	55.1	73.0	*
Canada	41.9	52.0	54.6	45.6
Argentina	61.3	38.8	46.3	*

* Not available

TABLE 2 — CANADIAN HONEY PRODUCTION, EXPORTS, IMPORTS, AND PACKAGE BEE IMPORTS.

Year	Honey production		Honey exports		Honey imports		Package bee imports	
	'000 lb	$'000	'000 lb	$'000	'000 lb	$'000	'000	$'000
1974	45,617	21,992	6,992	3,697	757	*	342	5,053
1973	54,643	26,739	16,098	6,727	643	364	303	2,050
1970	51,041	8,269	9,009	1,867	572	198	230	1,215
1967	45,682	7,739	4,325	1,059	2,661	431	249	1,312
1964	36,662	6,655	4,915	1,215	2,803	497	186	935

* Not available



Transport of package bees

long winter confinement period.

Many beekeepers in Western Canada have invested heavily in controlled-environment wintering facilities. This is one way to take some risk out of wintering colonies. However, the economics and success of this system have not been fully evaluated.

Additional sources of queens and packages will provide another alternative to the beekeeper. The Alberta Department of Agriculture has recently initiated a progam to bring queens and packages into Canada from Mexico. During the last three years, under this program 15,000 queens and about 2,000 packages have been brought into Canada. Although development of alternative sources of supply is important, it appears that wintering an increasing number of colonies will play a greater role in stabilizing the Canadian beekeeping industry.

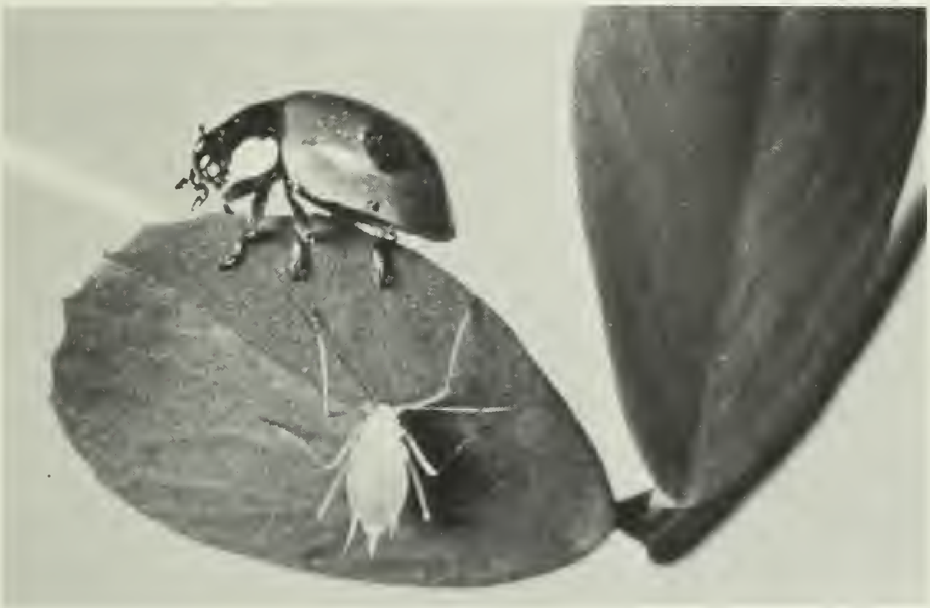
In 1975 an estimated 25,000-30,000 colonies were wintered in Western Canada (excluding southern B.C.) In 1969 there were only an estimated 6,000 colonies wintered. This trend will likely continue.

During the next 10 years, the beekeeping industry in Western Canada will gradually shift to become more self-sufficient. This will demand that researchers and beekeepers continue to develop improved wintering methods, management systems, queen evaluation techniques, and gain a greater understanding of the behavior and social organization of the honey bee colony. ■

APHIDS, CLIMATE, AND LADYBEETLES

B. D. FRAZER

Les effets des coccinelles sur les populations de pucerons ont fait l'objet d'études. Les résultats prouvent que les coccinelles sont bénéfiques à l'homme: la plupart des coccinelles adultes consomment volontiers l'équivalent de leur poids en pucerons au cours de quelques journées chaudes et les larves en font de même presque tous les jours. D'un autre côté, même s'il nous est possible de préserver, de multiplier et d'aider les coccinelles, nous ne pouvons pas nous limiter à ces agents pour réprimer les pucerons sur nos précieuses récoltes.



Hide and seek.

The colorful ladybeetles are widely believed to be beneficial to man: but whether this reputation is deserved is not well known. For instance, how much help can the ladybeetles really offer in controlling aphids on valuable crops. The task is formidable. The average female aphid can produce about 80 young in her lifetime. In Vancouver it is warm enough for long enough that up to 18 generations of aphids are produced each year. If all the progeny of a single aphid survived they would weight 10^{19} tons. But the mass of the earth itself is only 10^{16} tons.

Fortunately, not all aphids do survive. Researchers have long noticed that aphids are far more numerous in some years than in others, particularly in years that are cooler than normal. Under warm, humid conditions, epidemics of disease often decrease populations dramatically. We have a record of an aphid population being reduced a thousandfold in only three days. Decreases occur often in late spring when it is hot and when many ladybeetles are present.

Until recently, we could not separate the effects of all the factors influencing aphid numbers. Now, computers can be used to simulate the population dynamics of aphids and the effects of the many interacting factors.

In 1972, we observed a classic crash in a population of pea aphids on alfalfa when it was warm and there were many ladybeetles of several species present. Our research focused on the causes of this crash, particularly on the question: were the ladybeetles responsible?

In earlier models, predators were shown to have no effects on the pattern of abundance of cabbage aphids in Australia or of thimbleberry aphids in British Columbia. When the predators arrive and eat some of these aphids, competition is relaxed and the populations quickly recover. In a sense, the predators live on interest, whereas in this case of the pea aphid they made inroads into capital and reduced it.

For mathematical convenience, current theories of predation assume that predators search at random. This assumption is probably seldom true for individual predators but it does neatly average the effects of many predators when they are living on interest. In our case this assumption predicts aphid mortalities far greater than any we actually saw.

We had to find out therefore how the beetles really search for their prey. To do so, we followed every movement of individual hungry beetles in controlled laboratory conditions. Times spent in moving, resting, eating, and cleaning were recorded along with the movements

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Alert mature pea aphid on alfalfa

Adalia bipunctata eating a captured pea aphid on alfalfa

Antero is immature pea aphid on alfalfa.

of the aphids. To us, the beetles appeared hopelessly inefficient at finding aphids: although they have good eyes, they do not seem to recognize aphids as food; a beetle will ignore an aphid until it is touched with the beetle's sensory appendages.

The pea aphid, on the other hand, often seems to sense the movement, smell, or sight of an oncoming beetle so that the aphid jumps, drops, or rapidly walks off the plant. Older aphids are most likely to do this; younger aphids seldom move unless dislodged by another aphid or a beetle.

At low temperatures, most beetles simply sit and wait, even though they can move if prodded. The higher the temperature, the faster and more often they move. But the aphids, also being cold-blooded, are similarly affected by temperature. Nevertheless, on very warm days, the beetles can eat more aphids than may be born.

If warm weather continues, the number of aphids will be drastically reduced. As the aphid population decreases, the beetles have more difficulty locating the remaining aphids. Soon the beetles get hungry and fly away, leaving the few aphids to increase unmolested.

It is clear that beetles cannot be expected to reduce aphid numbers for long periods. In our study, the beetles decreased the numbers of aphids only once in four years, when spring temperatures were well above normal. In most years, the beetles can reduce only the rate at which an aphid population reaches damaging levels.

This illustrates the limited value of buying ladybeetles for liberation into infested fields or gardens. If the liberation is made in early spring when aphids are scarce, the ladybeetles will soon get hungry and fly away. If it is made when aphids are numerous, the beetles will probably not be able to reduce the total number of aphids but only the rate of increase. Serious damage to crops may follow if effective ways of reducing aphid numbers are not used.

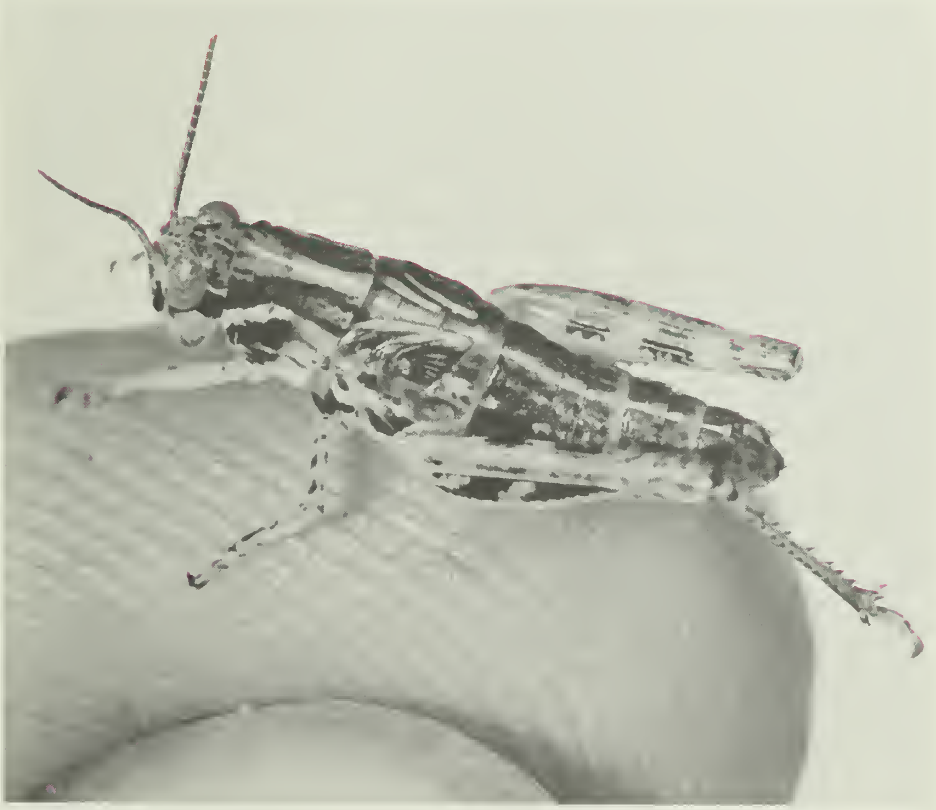
We have given serious thought to selecting strains of flightless beetles whose eggs could be distributed within a crop. Ladybeetle larvae are wingless, looking like six-legged alligators, and are far more voracious than the adults. We could predetermine the number of larvae needed, given the aphid density.

We can conclude that ladybeetles and their larvae have earned their reputation as beneficial insects. Most adults readily eat their own weight of aphids in a few warm days; their larvae do so almost every day. We can preserve, augment, and assist the ladybeetles, but we cannot rely solely upon them to control aphids on valuable crops. ■

CATCH THEM YOUNG

K. S. McKINLAY and
R. E. UNDERWOOD

Des chercheurs de la Station de Saskatoon commentent des essais sur le dosage d'insecticide contre des sauterelles de poids et d'âges différents. Les résultats suggèrent que, dans la plupart des cas, la résistance des sauterelles croît avec l'âge.



A fourth-instar nymph of *Melanoplus sanguinipes*. Grasshoppers should be sprayed before they get this big.

Most people recommend applying insecticide sprays to grasshoppers as early as possible when the grasshoppers are young and small . . . before they have had time to eat much of the crop. That advice sounds logical, but at the CDA Research Station at Saskatoon, we decided to find out how the results of spraying could be affected by the size of the grasshopper. Does it really take a stronger, more concentrated spray to kill a large grasshopper than a small one and, if so, how much stronger?

The response of any animal or insect to a drug or poison usually depends on body weight; adults are given larger doses of medicine than children. Therefore, you would expect to use more insecticide to kill a larger, older grasshopper than to kill a smaller, younger one. Moreover, the dosage seems to be regulated automatically to some degree: a larger grasshopper has a larger surface area and will therefore collect more spray as the boom goes over it.

But what happens to plan-area and body weight as an insect gets bigger? As an insect doubles its linear dimensions, its plan-area will increase four times but its weight will increase eight times. The area goes up proportional to the square but body weight goes up proportional to the cube. Thus the insect twice as large has only half as much area per unit of body weight and will only collect half as much spray per unit of body weight.

We measured the amount of spray actually collected by grasshoppers of different sizes and weights by spraying them with a water soluble, fluorescent dye. The results of these experiments are shown in Table 1.

We found that the grasshoppers collected roughly the same amount of spray per unit area regardless of stage of development; the differences, although sometimes significant, were small. However, because the relationship between body weight and plan-area changes with growth, we found significant differences in the amount of spray per unit of body weight: compared with the second instar, the third instar collected 32% less, the fourth instar, the fifth instar, and the adult male each about 50% less, and the adult female 66% less.

Based on these findings, you would expect to be able to use less insecticide in the spray, or get better control for the same amount,

K. S. McKinlay is a toxicologist and R. E. Underwood the photographer at the Agriculture Canada Research Station at Saskatoon, Sask.

Standard spray nozzles are carried along an overhead track so that sprays can be applied with field equipment under controlled conditions in the laboratory. Half-inch spheres are used as a standard target for comparison in laboratory or field. They have the advantage that they present the same cross-sectional area whatever the direction of the spray. In this experiment deposits are being measured on adult and fourth-instar nymphs in either horizontal or vertical positions.

if you sprayed the younger hoppers. However, many other factors are involved, such as differences at each stage in ability to detoxify the chemical, or in thickness of cuticle. Therefore we tested three insecticides to find out the dosages needed to control grasshoppers of different ages. Table 2 shows the amounts of dimethoate, carbaryl, and carbofuran needed to kill 50% (L.D.50) of various stages of the grasshopper, *Melanoplus sanguinipes.*

In most cases, we needed to apply more insecticide to control larger and older grasshoppers. However, carbaryl was an exception: we needed less insecticide to kill fourth-instar hoppers than to kill second-instar, yet we were unable to kill adult males with any reasonable dosage (i.e., less than 7000 g/ha).

In Table 3, we have calculated the amount of insecticide needed per unit of body weight to kill 50% of each stage (based on the data from Tables 1 and 2).

Table 3 shows that the different stages are not equally susceptible, even on a body-weight basis. Dimethoate and carbofuran show a general tendency to be less toxic to the later stages; you need more insecticide for an equivalent kill than you would suspect from their increased weight. Carbaryl is, again, the exception, in that second-instar nymphs are much less susceptible than fourth-instar.

In general, our results suggest that not only do the hoppers collect less spray per unit of weight as they get older, but they also tend to be less susceptible to the insecticide on a body-weight basis. However, this tendency cannot be taken as a general rule because one insecticide out of the three, carbaryl, was quite ineffective against adults at practical dosage levels, and was more effective against fourth-instar than second. But the data do suggest that in most cases grasshopper control will get progressively more difficult as the hoppers get older and that it will pay to "catch them young". ■

TABLE 1 – VOLUME OF DEPOSITS OF DYE ON GRASSHOPPERS SPRAYED AT 11.2 LITRES/HA (1 GAL/AC)

Grasshopper				Volume of deposit of dye per	
Stage	Weight (mg)	Area (mm^2)	Weight/ unit area (g/cm^2)*	Unit area (nl/cm^2)*	Unit body weight ($\mu l/g$)*
II	9.4	10	9.4	89 b	.79 a
III	20	16	12.5	71 a	.54 b
IV	108	61	17.7	68 a	.37 d
V	172	90	19.1	86 b	.41 cd
Adult ♂	281	118	23.8	101 c	.42 c
Adult ♀	372	142	26.2	73 a	.27 e

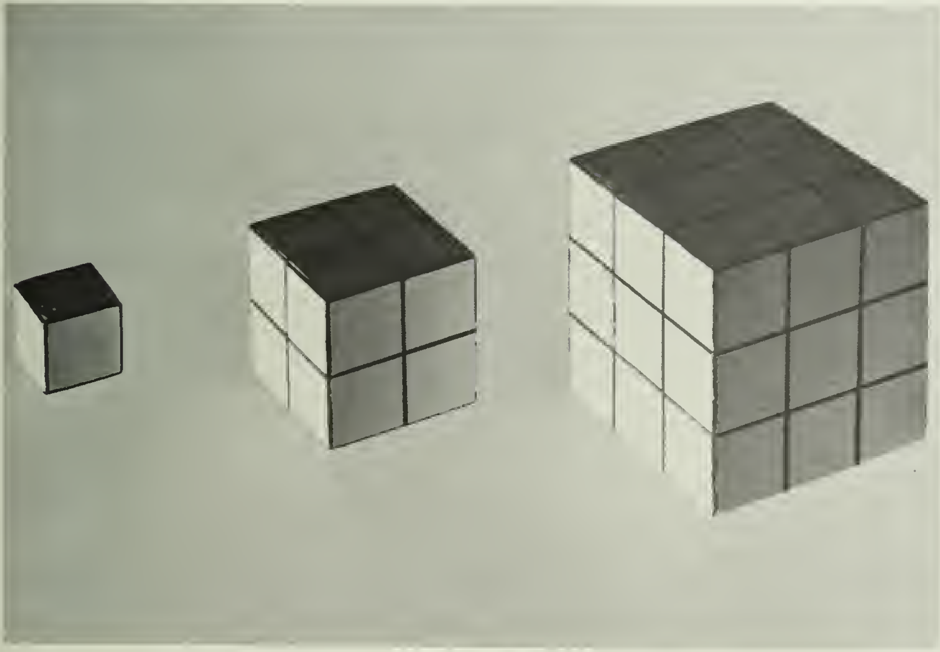
* Within any one column, figures followed by the same letter are not significantly different at the 5% level.

TABLE 2 – AMOUNT OF INSECTICIDE (G/HA) NEEDED TO KILL 50% OF GRASSHOPPERS *(M. SANGUINIPES)* AT DIFFERENT AGES

	IInd instar	IVth instar	Adult male
Dimethoate	111	160	348
Carbaryl	1062	488	>7000 g/ha
Carbofuran	9.2	28	37

TABLE 3 – AMOUNT OF INSECTICIDE PER UNIT OF BODY WEIGHT (UG/G) NEEDED TO KILL 50% OF GRASSHOPPERS *(M. SANGUINIPES)* AT DIFFERENT AGES

	IInd instar	IVth instar	Adult male
Dimethoate	2.33	1.57	3.89
Carbaryl	22.3	4.8	—
Carbofuran	0.19	0.28	0.41



Size, plan-area, and weight. Let the smallest cube have unit-weight and unit plan-area (upper shaded surface). Then if you double the linear dimensions the plan-area becomes 4 units (2^2) and the weight 8 units (2^3). Increase the size 3 times and the plan area becomes 9 units (3^2) and the weight 27 units (3^3). The small cube will receive 3 times as much spray per unit weight as the largest cube and twice as much as the middle cube.

ECHOES

FROM THE FIELD AND LAB

A LITTLE RAIN DOESN'T HURT When sheep producers sell lambs after a rain, the buyer frequently questions the weight of water in the wool. "These's no easy answer to this question because many factors influence the gain", says Dr. J. A. Vesely, an animal geneticist at the CDA Research Station, Lethbridge, Alta. But Dr. Vesely has produced a rough guide that may be used by the producer and buyer.

To measure the effect of rain on the weight of lambs, Dr. Vesely compared sheared and unsheared Suffolk and Rambouillet lambs. After weighing all the lambs, they were sprayed with water until completely saturated, then weighed again. Three more weighings followed at 1-hour intervals with drying in an open pen between each weighing. The lambs weighed about 100 lb when dry. The unsheared Suffolk lambs gained about 4 percent when soaked and the sheared lambs only 1 percent. For the Rambouillets, the gains were 5.5 percent and 1 percent.

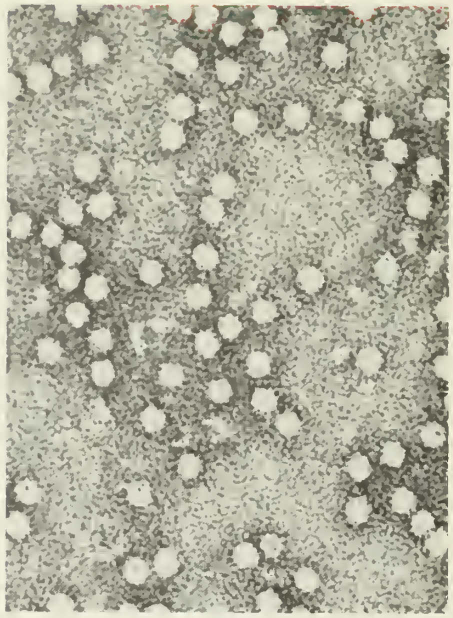
After 1 hour of drying, the sheared lambs had returned to their original dry weight. The unsheared Suffolks were about 2.5 percent heavier than their dry weight and the Rambouillets 3 percent heavier. After 3 hours of drying, they were all about the same weight as they were before being soaked.

Dr. Vesely says that the amount of weight change due to wetting and drying was also confounded by other factors, although these were of minor importance. However, he notes that these measurements were made during June and July when the high day temperature was 23-30°C and the relative humidity 48-85 percent

SHEEP VIRUS ISOLATED H. J. Cho, an immunologist with CDA Animal Diseases Research Institute (Prairie Area) near Lethbridge, has succeeded in isolating the virus that causes scrapie in sheep

While scrapie itself only occasionally causes economic losses to the sheep industry in Canada, the procedures that Dr Cho developed in his search for the scrapie virus could place a new tool in the grasp of researchers seeking the unknown agents that cause multiple sclerosis and other degenerative diseases in humans.

Dr Cho, following a new pattern of research he developed, formed a suspension of fine brain tissue of scrapie-infected mice. He treated the suspension with freon 113 to remove the brain tissue and leave only the disease-causing agent. He subjected the suspension to repeated centrifugal treatment to purify the agent.



Sheep scrapie virus magnified 255,000 times.

The scrapie virus is the smallest virus found to date and measures only 14 nanometers. It was photographed at ADRI, Ottawa, in cooperation with Dr. A. S. Greig, head of Cytology and Electron Microscopy.

HARVESTING TRENDS IN TREE FRUITS Within 10 years, most tree fruit will be harvested by machine to avoid labor problems. This was one important trend identified by a recent workshop on the engineering aspects of harvesting, handling, grading, and packaging deciduous tree fruits.

Agriculture Canada researchers at Summerland, B.C., Mr. A. D. McMechan and Dr. S. W. Porritt, attended the workshop organized by the Agricultural Research Service, USDA

To mechanize the tree fruit industry, research will help to develop tree forms and harvesting equipment that minimize fruit damage. Equipment will also be needed for electronic sorting for weight, color, surface damage, and internal quality.

But mechanical harvesting is not without its problems. The small farm, using family labor to handpick a high quality fruit, may still be able to compete.

NEW BARLEY CULTIVAR LICENSED Agriculture Canada recently licensed Klondike, the ninth in a series of barley cultivars developed at the research station at Brandon, Manitoba over a period of forty years.

Klondike is a six-rowed, feed type, spring barley that has proven high yielding across Western Canada, some areas of the north central U.S., and on the Eastern Canadian Prairies. It is resistant to stem rust and has some resistance to root rot, three barley smuts, spot blotch, net blotch, and Septoria leaf blotch. It is moderately susceptible to scald and susceptible to leaf rust and mildew.

Select seed is being distributed in the spring of 1976 to Select Seed Growers in the prairie provinces who have been chosen by the provincial Stock Seed Distribution Committees. Some Foundation seed has also been released through the seed trade for increase in 1976. By 1977, limited quantities of seed should be commercially available for seeding.

EVALUATING SOIL MOISTURE RESERVES In spite of great technological progress, weather remains the cause of most farming problems and the wide variations in yield between seasons and areas.

Water is usually the limiting factor. For this reason, the Agrometeorology Research and Service Section of the Chemistry and Biology Research Institute, Agriculture Canada, has initiated a Soil Moisture Evaluation Project (SMEP) for the 1976 growing season. The test area is the wheat producing area of southern Saskatchewan.

Daily weather information from a selected number of climatological stations will be fed into a computer at the Central Experimental Farm in Ottawa. Maps will be produced periodically depicting the current soil moisture reserves for three textures of soil — sandy, loamy, and clay. Two field conditions, stubble and fallow are considered

This information will be useful to farmers in deciding what to plant, seed rate, row spacing, and amount of fertilizer to apply Stress periods can be related to expected yields in dryland farming and to the application of supplemental water in the case of irrigation farming.

A report will be released primarily to grain companies, marketing boards, and agencies providing advisory services to farmers

ECHOS
DES LABOS ET D'AILLEURS

SASK. TO GET NEW RESEARCH CENTER The University of Saskatchewan has organized an animal production research center (APRC) to coordinate and extend research aimed at improving the production of livestock and poultry. APRC will concentrate on the problems of Saskatchewan producers but its work is expected to benefit all western Canada.

The first major project of the center is to establish a $600,000 swine research unit. The Saskatchewan government is providing initial funding for the unit, which will focus on housing, reproduction, baby pig survival, and nutrition.

The center will enable the university to direct a multidisciplinary attack on production problems in beef and dairy cattle, sheep, swine, and poultry.

MOYEN DE RÉDUIRE LE NOMBRE DE PYRALES DE LA POMME Un système établi pour dénombrer le nombre de pyrales de la pomme s'est avéré un moyen efficace d'en réduire le nombre.

Cette méthode pourrait remplacer la lutte chimique contre ce ravageur qui, à sa phase larvaire, perce des trous dans les pommes prêtes à mûrir. Les économies que réaliseraient les pomiculteurs seraient considérables.

Des chercheurs de la station fédérale de recherches de Kentville (Nouvelle-Ecosse) utilisaient des pièges amorcés avec un attractif sexuel synthétique pour surveiller les populations de pyrales de la pomme. Les pièges étaient suspendus aux arbres du verger et le nombre de pyrales mâles prises au piège indiquaient le besoin d'appliquer des traitements avant que les larves n'éclosent.

On a constaté avec étonnement que les pièges utilisés dans un verger de 3.2 ha (8 acres) à Kentville réduisaient réellement la population de pyrales de la pomme. Les chercheurs supposent qu'une partie de ce succès inattendu serait attribuable à la découverte d'un nouvel attractif chimique plus efficace. Les pièges amorcés avec le nouvel attractif ont attiré trois fois plus de mâles qu'auparavant.

M. Roger MacLellan, entomologiste à la Station de recherche espère que les pièges pourront être utilisés à l'échelle commerciale pour atténuer les problèmes de la pyrale de la pomme. «Nous avons, dit-il, court-circuité le stade de la reproduction dans le cycle vital de la pyrale en réduisant le nombre des mâles, et d'après les résultats obtenus jusqu'ici, l'utilisation future de ces pièges pour décimer les populations de cet insecte semble prometteuse.»

Il y a actuellement de 50 à 75 pomiculteurs qui utilisent des pièges pour surveiller les populations de pyrales de la pomme en vue de déterminer les besoins de pulvérisation. D'autres utilisent en plus grand nombre de pièges dans les vergers pour réduire ces populations.

TOMATO HARVESTER FOR SMALL FARMS A new tomato harvester has been developed by an Ontario tomato grower under the Development, Research, and Evaluation of Agricultural Mechanization program (DREAM). The new harvester, which is semi-mounted on a tractor, can harvest 2 acres per day and is suitable for acreages ranging from 15 to 60.

Tests during the 1975 growing season showed that the machine can harvest marketable tomatoes of equal or better quality than handpicked fruit. Although the harvester has potential for reducing costs, its real value is as an alternative to scarce labor for handpicking.

Peter W. Voisey of Engineering Research Service provided guidance to the developer in carrying out this DREAM project. He reports that additional tests will be run during the 1976 growing season, by which time the first commercially manufactured machines will be in operation.

New tomato harvester for farms of 15 to 60 acres.

NO TILLAGE! Farmers and researchers throughout the prairie region of Canada and the U.S. are taking a close look at the possibilities of zero tillage. Less tillage has obvious attractions: savings in the cost of fuel and equipment, and conservation of soil.

Although experimental results have been favorable, agrologists at the Agriculture Canada Research Station at Lethbridge warn that widespread use of the technique may be premature. Representatives of chemical and machinery industries are enthusiastic, but researchers say that Canadians need cheaper herbicides and better seeding equipment before zero tillage can be recommended for the Canadian prairies.

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