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Prediction of duck nest survival in conventional and zero-tilled stubble fields

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Abstract

Survival of duck nests in stubble fields under conventional tillage as well as zero-tillage was predicted by comparing the chronology of stubble cultivation, spring seeding, and nest initiation dates. The probability of a conventional stubble field remaining free of cultivation long enough for a clutch to hatch was only 0.5 for the earliest nests, and was almost negligible for a majority of nests. Early nests in zero-tilled fields probably would be destroyed by the seeding operations, but renesting should compensate for some of these losses. After early May, increasingly more fields would be seeded and thus would provide safer nesting sites. The overall success of duck nests would be higher in zero-tilled fields than in stubble fields that are annually cultivated.

Introduction

The importance of prairie Canada for the production of waterfowl, particularly ducks, is well known (Munro and Gollop 1955, Pospahala *et al.* 1974). Over half the ducks taken by North American hunters are produced in this region, mainly on private farmlands. However, in recent years there has been a growing concern over the loss of this waterfowl habitat through intensive farming. Both wetland and upland habitats are involved. Cultivation of upland has left little habitat suitable for wildlife on many farmlands and the trend is continuing (Sugden and Beyersbergen 1984).

Intensive farming reduces the upland cover preferred by nesting ducks; nests in cropped fields are vulnerable to farming activities and those in remnants of native cover are subject to high predation losses (Duebbert and Kantrud 1974, Higgins 1977, Krapu 1977). Early-nesting species such as Pintails (*Anas acuta*) that depend on residual vegetation from the previous year are affected most.

All possible strategies that may help to offset these impacts should be considered by waterfowl managers (Zittlau 1979). One strategy is the use of alternative farming methods that improve nesting success for ducks without imposing a liability upon the farmer, such as zero-tillage (Higgins 1977, Cowan 1982, Rodgers 1983). Although the practice of zero-tillage is in its infancy on the Canadian prairies, it is increasing and there is a growing interest as its advantages in soil and energy conservation become more apparent (Saskatchewan Tillage Committee 1981). Thus, it would be useful to know its potential for influencing duck production should the trend continue. In this paper we compare the probable survival rates of duck nests in stubble fields with and without zero-tillage farming.

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Study area and methods

Originally we intended to measure the use of zero-tilled stubble fields by nesting ducks as well as nest survival in such fields. However, zero-tilled fields near suitable wetland habitat appeared non-existent. Therefore, we monitored the use of conventional stubble fields not designated for cultivation before June. By then a majority of nests would have been started. Since we found virtually no use of stubble fields by nesting ducks, we could only predict survival from farming activities based on associated data.

Most of our nest data were obtained on the Canadian Wildlife Service (CWS) St-Denis National Wildlife Area, 32 km east of Saskatoon. The 385-ha block of rolling farmland consisted of approximately 10% wetlands, 26% untilled upland, and 64% cultivated. In 1980 and 1981 we searched stubble fields once or twice in May (Higgins *et al.* 1969). The remaining cover was systematically searched three times in both years between early May and late July. We estimated nest initiation dates from available data on the stage of egg incubation (Westerskov 1950), clutch size, hatching dates, and published estimates for incubation periods.

In 1981 we added 10 blocks of private farmland to increase our sample of stubble fields. Located within 30 km of the St-Denis National Wildlife Area, these ranged from 58.5 to 198.1 ha, and averaged 97.0 ha. Stubble fields on these blocks ranged from 39.4 to 163.3 ha, and averaged 70.9 ha. All of the blocks either contained wetlands or were adjacent to at least one. Annually tilled land made up 62% to 94% of the areas, and averaged 81%. We made one nest search on these blocks during May before the stubble fields were cultivated. Searches included all upland cover.

We obtained data on farming activities by monitoring 104 fields at 5-day intervals along 45 km of roadside transect near the research area. We noted the status of each field, such as uncultivated stubble, cultivated, or seeded. There were no zero-tilled fields in our samples.

Results

Nest study

We found 208 duck nests in upland cover on the research area in 1980, and 61 in 1981. None was found in stubble fields. The comparatively low number in 1981 was attributed to drought conditions and deteriorated habitat in that year. During our search of the 10 private farmland blocks in 1981, we found 19 nests: 17 Mallard (*Anas platyrhynchos*), one Pintail, and one Shoveler (*A. clypeata*). Stubble fields on these blocks yielded only one Mallard nest.

We were able to estimate initiation dates for 189 nests in 1980 and 50 in 1981 (Fig. 1). Because there was only one search on the private farmland blocks, we have not included data from those areas. The earliest nests were initiated about mid-April by Mallards and Pintails. The overall pattern among species was similar to the one depicted by Hochbaum (1944:94). However, on our area, Mallards and perhaps Pintails had a second peak that differed little from

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the main peak for the Shoveler, Wigeon (*A. americana*), and Blue-winged Teal (*A. discors*).

Farming activities

There were 68 stubble fields on our transect after the 1979 harvest; 20 were then cultivated that autumn, leaving only 48 in the spring of 1980. Most of the fields cultivated in the autumn had been given the "one-way" treatment, which does not remove all of the standing stubble. Thus, they may not have lost all of their potential for duck nesting cover (Higgins 1977).

The spring of 1980 was warm and dry, and some cultivating was underway by 20 April; most was finished by mid-June (Fig. 2). Generally, the first fields to be cultivated, including those done in the autumn, were designated for seeding. Fields to be summerfallowed were cultivated last. Seeding was started on about 30 April and was completed by 4 June (Fig. 3).

The chronology and pattern of stubble cultivation were similar in 1981, another dry year (Fig. 2). Seeding averaged about a week later, however, and was probably closer to average (Fig. 3). Data for 1952–83 supplied by Saskatchewan Agriculture show that the average date when "seeding is general" in this area was 13 May. This corresponds to the date of 50% completion in our 1981 sample.

Discussion

By comparing the chronology of various farming activities with nest initiation and hatching dates, we can predict some effects of these activities on the overall success of nests in cropland. During our 2-year study, approximately 35% of the fields were summerfallowed, so the balance represented potential stubble cover for nesting ducks. However, some of these were lost to fall cultivation, and approximately 43% of the fields were uncultivated stubble in the following spring.

Despite the late tillage of some stubble (Fig. 2), few fields would benefit stubble-nesting ducks. The probability of a stubble field remaining untilled long enough for a clutch to hatch (assuming a 35-day exposure period) was never greater than 0.5 after mid-April (Fig. 4). By late April it was only 0.2, and by mid-May less than 10% of the few remaining stubble fields would have proved safe for a nest initiated then. Because most nests are started after April (Fig. 1), it is apparent that cultivated stubble fields could not be considered useful nesting habitat.

Our findings reaffirm the results of previous studies in which direct measurements could be made of nest success in cultivated fields (e.g. Milonski 1958, Higgins 1977). Stubble fields under conventional cropping systems have little to offer nesting ducks. Indeed, they are likely to represent a "trap" most of the time and, at best, provide high-risk sites for very early nesting ducks. The comparatively low use of the extensive stubble fields on our study blocks may reflect a tendency for ducks not to select nesting cover where they have been previously unsuccessful (Hildén 1965, Doty and Lee 1974).

Why ducks apparently made greater use of stubble in the past despite low nest survival (e.g. Milonski 1958) is not clear. It may have been in response to the much higher populations then present (see Fretwell 1972 for discussion). As well, there were probably higher proportions of young females in the nesting populations, and those may have been the birds that tended to pioneer into new habitat, albeit of low quality.

Under a zero-tillage system, stubble fields are not cultivated and seeding is done directly into the stubble. Weeds are controlled by chemicals. Overall, there is little or no difference in seeding dates between conventional and zero-tilled fields. Heavy snowfall in the previous winter may delay seeding into stubble fields for a few days because of moisture conditions. Conversely, in dry springs, less moisture in zero-tilled fields allows earlier seeding. Nests initiated before seeding was underway would have but slight chance of survival (Fig. 5). However, those started in a field after it was seeded would escape that operation, though later they may be exposed to the mechanics of herbicide spraying. Using the 1981 seeding data (which we consider most representative), we predict that nests started after 15 May would have better than a 50% chance of being in a "safe" field, with the odds increasingly favouring late nests. As most nests are initiated after mid-May (Fig. 1), the advantage of zero-tilled fields over conventional stubble fields for nesting ducks is obvious.

Because of the large areas under cultivation, duck nests in stubble fields tend to occur at low densities. Such nest dispersal may reduce the predation rate (Cowan 1982), a notion consistent with previous results (e.g. Tinbergen *et al.* 1967, Fretwell 1972, Page *et al.* 1983), as well as our own unpublished results of tests with American Crows (*Corvus brachyrhynchos*).

Whether zero-tilled fields would attract more nesting ducks than conventional stubble fields is unknown. We have little doubt, however, that relatively fewer nests would be lost from farming activities, assuming that the increased use of herbicides associated with zero tillage cropping is not harmful to duck eggs (Batt *et al.* 1980, Hoffman and Eastin 1982). Loss of early nests in zero-tillage fields would be compensated for, in part at least, by renesting. In future the application of new farming techniques, such as cultivating with undercutters (Rodgers 1983) and seeding with pneumatic drills, should improve survival of nests in annually cropped fields.

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References

Batt, B.D.J.; Black, J.A.; Cowan, W.F. 1980. The effects of glyphosate herbicide on chicken egg hatchability. Can. J. Zool. 58:1940–1942.

Cowan, W.F. 1982. Waterfowl production on zero tillage farms. Wildl. Soc. Bull. 10:305–308.

Doty, H.A.; Lee, F.B. 1974. Homing to nest baskets by wild female Mallards. J. Wildl. Manage. 38:714–719.

Duebbert, H.F.; Kantrud, H.A. 1974. Upland duck nesting related to land use and predator reduction. J. Wildl. Manage. 38:257–265.

Fretwell, S.D. 1972. Populations in a seasonal environment. Princeton Univ. Press.

Higgins, K.F. 1977. Duck nesting in intensively farmed areas of North Dakota. J. Wildl. Manage. 41:232–242.

Higgins, K.F.; Kirsch, L.M.; Ball, I.J., Jr. 1969. A cable-chain device for locating duck nests. J. Wildl. Manage. 33:1009–1011.

Hildén, O. 1965. Habitat selection in birds. Ann. Zool. Fenn. 2:53–75.

Hochbaum, H.A. 1944. The Canvasback on a prairie marsh . Am. Wildl. Inst., Washington, DC.

Hoffman, D.J.; Eastin, W.C., Jr. 1982. Effects of lindane, paraquat, toxaphene, and 2,4,5-trichlorophenoxyacetic acid on Mallard embryo development. Arch. Environ. Contam. Toxicol. 11:79–86.

Krapu, G.L. 1977. Pintail reproduction hampered by snowfall and agriculture. Wil. Bull. 89:154–157.

Milonski, M. 1958. The significance of farmland for waterfowl nesting and techniques for reducing losses due to agricultural practices. Trans. North Am. Wildl. Conf. 23:215–227.

Munro, D.A.; Gollop, J.B. 1955. Canada's place in flyway management. Trans. North Am. Wildl. Conf. 20:118–125.

Page, G.W.; Stenzel, L.E.; Winkler, D.W.; Swarth, C.W. 1983. Spacing out at Mono Lake: breeding success, nest density, and predation in the Snowy Plover. Auk 100:13–24.

Pospahala, R.S.; Anderson, D.R.; Henny, C.J. 1974. Population ecology of the Mallard. II. Breeding habitat conditions, size of the breeding populations, and production indices. US Dep. Inter., Fish and Wildl. Serv. Resour. Publ. 115.

Rodgers, R.D. 1983. Reducing wildlife losses to tillage in fallow wheat fields. Wildl. Soc. Bull. 11:31–38.

Saskatchewan Tillage Committee. 1981. Zero tillage. Sask. Agric. Plant Ind. Branch, Regina, Sask.

Sugden, L.G.; Beyersbergen, G.W. 1984. Farming intensity on waterfowl breeding grounds in Saskatchewan parklands. Wildl. Soc. Bull. 12:22–26.

Tinbergen, N.; Impekoven, M.; Franck, D. 1967. An experiment on spacing-out as a defence against predation. Behaviour 28:307–321.

Westerskov, K. 1950. Methods for determining the age of game bird eggs. J. Wildl. Manage. 14:56–67.

Zittlau, W.T. 1979. An environmental assessment of agricultural practises and policies: implications for waterfowl habitat management. Natur. Resour. Inst. Univ. Man., Winnipeg, Man.

Figure 1
Nest initiation dates of upland-nesting ducks. Each circle (1980) or square (1981) represents one nest

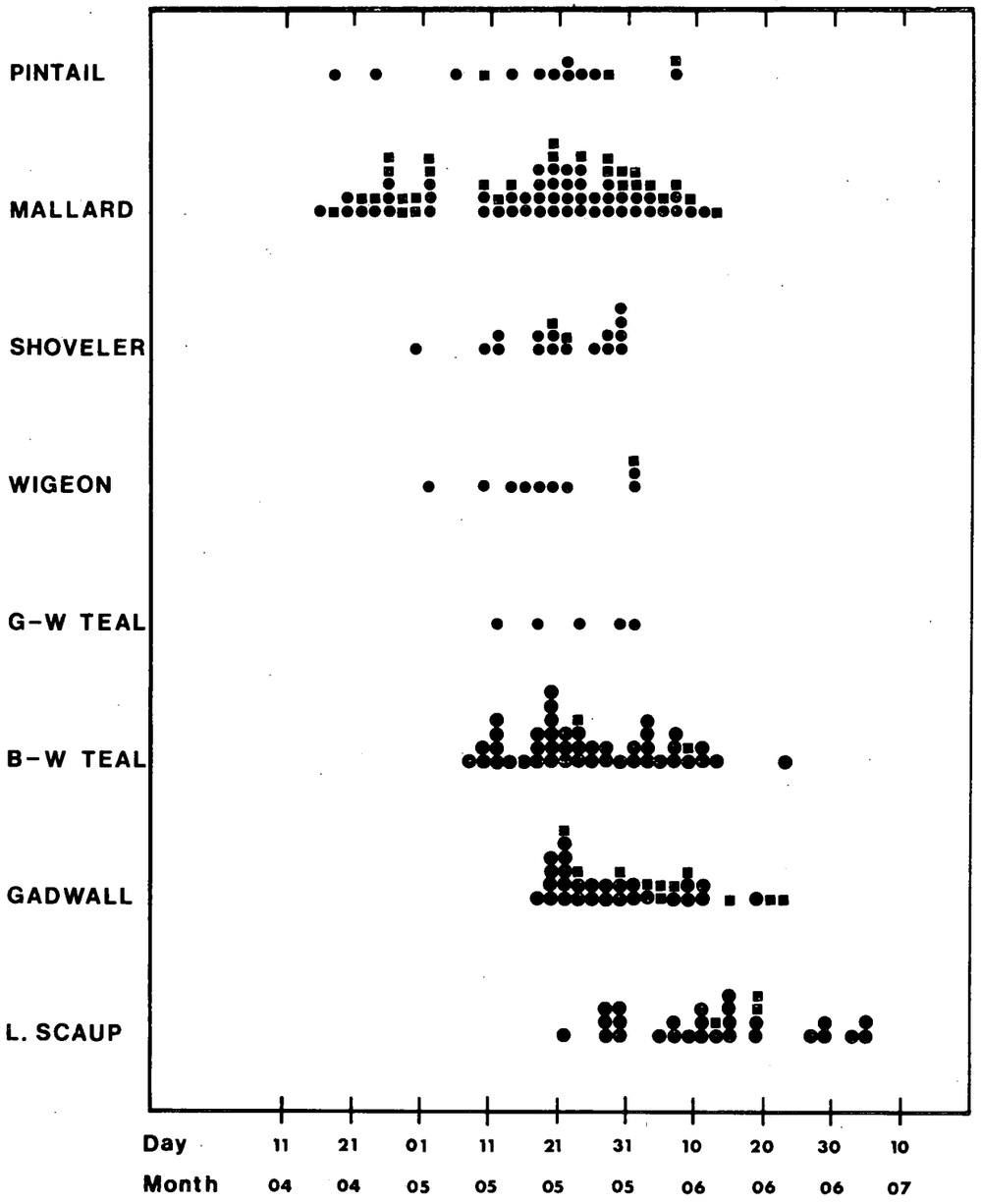

Figure 2
Chronology of stubble field cultivation in the St-Denis area

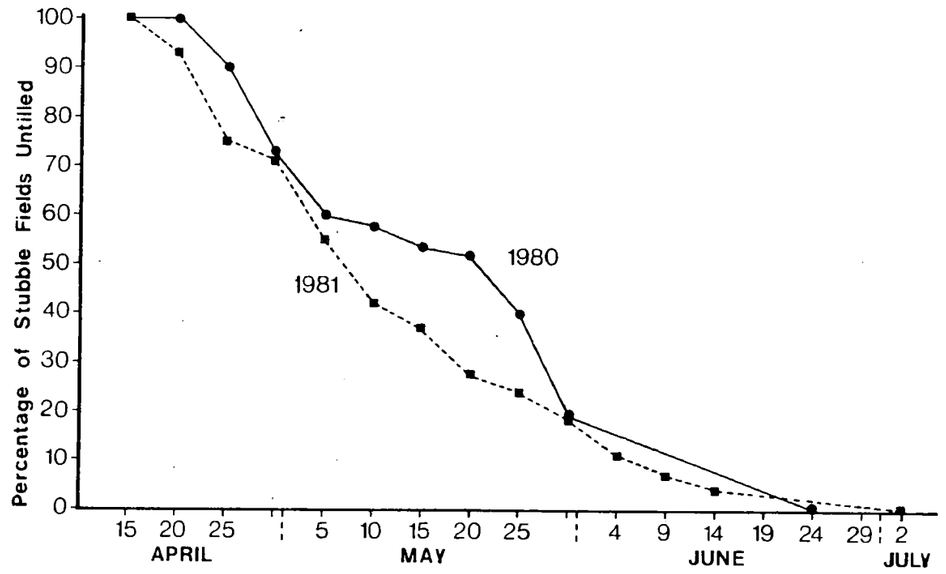

Figure 3
Chronology of seeding in the St-Denis area

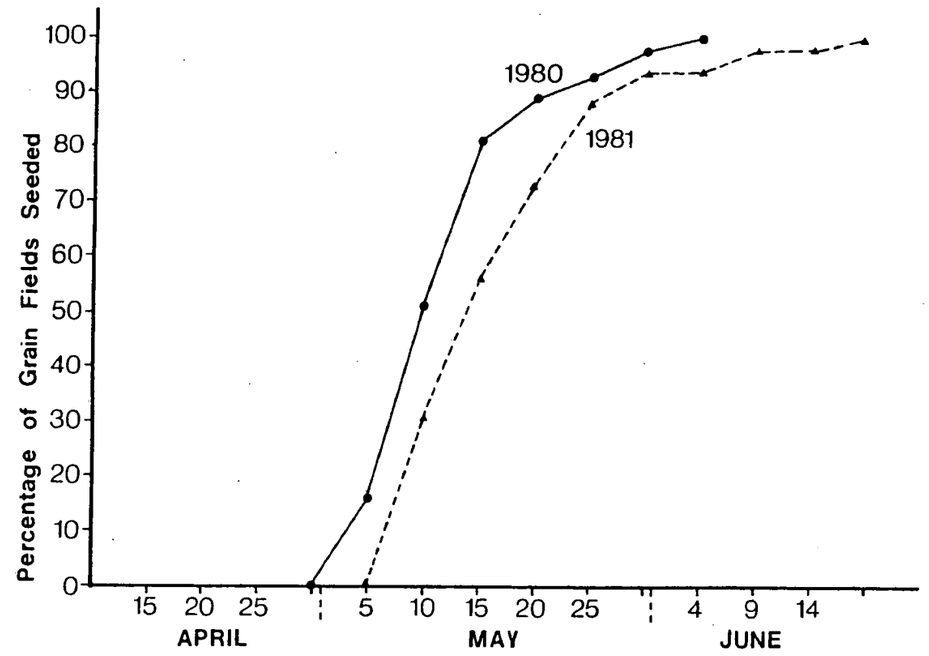

Figure 4
Probability of a stubble nest surviving cultivation under conventional tillage (35-day exposure period assumed)

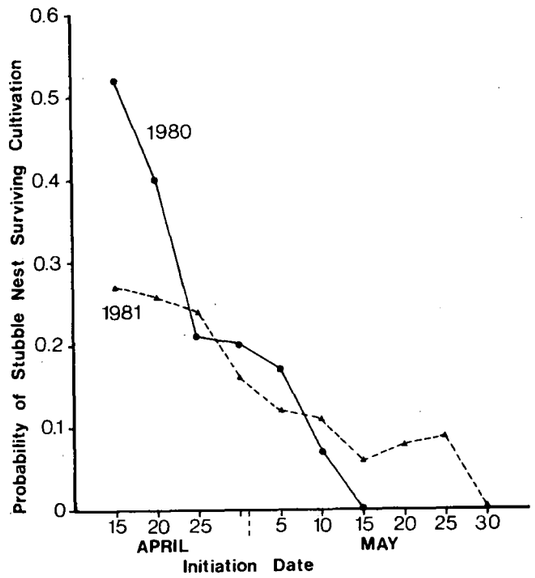

Figure 5
Probability of a stubble nest surviving the seeding operation under zero-tillage (seeding chronology based on 1981 data, and 35-day nest exposure assumed)