

SEED DRILL SURVEY

THE VALUE OF GRAIN DRILL SURVEYS IN STUDYING WEED PROBLEMS IN SMALL GRAINS*

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Introduction

An obvious and important factor in weed control is the sowing of clean crop seed. To achieve this, various measures have been introduced. These include the development of seed cleaning equipment, the introduction of certification schemes, and various legislative measures. But, even with such measures, there are two sources of seed supply which are difficult to evaluate, namely (1) home grown seed and (2) seed bought through interfarm sales. In both of these cases the quality of the seed depends on the practices adopted by the individual farmers concerned. One method which has proved valuable in investigating these sources of seed is by a grain drill survey. Samples of the crop seed are taken from the seed-drill when the seed is being sown in the field. The samples are subsequently analysed and the number of weed seeds sown can be estimated. Such surveys are valuable in other ways. The introduction to a new area of a species of plant which might create a major weed problem may be detected. The efficiency of the seed cleaning process can be studied. These surveys can also supply valuable information to agriculturists, plant pathologists, and farmers in extension meetings and field programmes.

Review of Literature

Seed drill surveys have been reported over the last 27 years, mainly from Canadian sources, though a few have been carried out in the United States. The main purpose of these surveys has been to find out exactly what quality of seed a farmer is sowing. The crops concerned have been chiefly cereals though a few have been recorded for grass and legume seedings. The mechanics of the grain drill survey method have been outlined by MacRae (15). Samples of cereals are collected from farmers' seed drills whilst operating in the field, by county agents, weed inspectors, and occasionally, volunteers. A questionnaire is taken at the time of sampling. The sample is then sent to the seed laboratory of the Plant Products division of the Canadian Department of Agriculture where purity analyses and weed seed counts are done. When the analyses are completed three copies of a control certificate are issued as follows:-

- (1) One copy to the farmer
- (2) One copy to the county agent
- (3) One copy to the Field Crops Branch of the particular province concerned.

The information on all individual reports remains confidential, i.e. the name of the farmer is not published. The results of the analyses for home grown seed or for seed purchased through inter-farm sales are based on the commercial standards as defined within the Seeds Act of Canada. It should be mentioned here that because of such a Seed Law the grading of seed becomes a Government responsibility.

Results have been published (3,4,5,6,7,8,13,14,15,16) from different provinces in Canada. The most significant feature shown by these surveys is the large number of samples classed as "rejected" because of a high total of weeds or for noxious weed seed content, e.g. a survey carried out in Saskatchewan in

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1953 (3), which is the main grain producing area in Canada, showed that of 750 oat samples 75% were classed "rejected" because of weed seeds.

There have been a few seed drill surveys reported in the United States (9,11,12,17). The results have been based on the presence of noxious weeds as listed by the individual states concerned. The separate states differ in their seed laws and in most cases it is only the number of noxious weeds, as laid down by state law, which must be reported, there being no overall grade standard for commercial seed.

All the literature on Seed Drill surveys would suggest that if the following three factors were employed:-

- (1) better cleaning facilities
- (2) use of better cultural methods
- (3) use of herbicides

cleaner cereal crops could be obtained and economies in production be effected.

Aim and Scope of Present Study

The aim of the present study was to carry out an investigation of a preliminary nature into the quality of oats used for seeding in a particular area in New York State, and to determine whether the results would merit an investigation of a wider nature over the whole state. Oats were chosen for two reasons; the first being that oats are generally grown in a normal New York rotation as the main companion crop for legume and grass seedings, and secondly, a large percentage of oat seed is home grown. This home-grown seed is either cleaned by the farmer himself or sent to a local cleaning plant. Data from cost account farms (1) show that in thirty farms, twenty, or two-thirds, suffered a loss on the oat enterprise in 1952 and that over the years 1948-52 about two out of three farms showed a loss in 3 out of 5 oat crops. It is possible then to assume that the oat crop might receive least attention as far as seed quality and weed control are concerned in a New York rotation.

The area chosen for the investigation was Tompkins County and the main points in the study were:-

- (1) the quality of seeds that farmers were sowing with particular reference to their weed seed content and the different species of weeds present.
- (2) the efficiency of cleaning equipment in removing weed seeds.
- (3) whether oat seedings were causal in introducing weeds such as Yellow Rocket (Barbarea vulgaris), Wild Carrot (Daucus carota), and White Campion (Lychnis alba), which are serious weeds in legume seedings.

Experimental Procedure

(1) Seed Drill Survey. In early spring some uncleaned samples of oats were collected from farmers' bins and used to test sampling and analyses techniques and also to identify weed species likely to be encountered in the investigation. Some of the farmers from whom such samples were taken were re-visited at seeding time and cleaned samples collected from the drills. These were used to get an idea of the efficiency of the cleaning operations.

A month before sampling, farmers in the county were informed by the county agent by local farming press and by radio broadcast of the nature and scope of the survey, and were asked for their co-operation. Sampling areas were not

pre-determined. The City of Ithaca was used as a starting point each day and as wide an area as possible was covered. Samples were taken at random from seed-drills operating in the field. A cylinder 12" long by 2½" in diameter was used for sampling. This was different from other surveys where the "hand grab" method was used. It was thought that by using the cylinder and sampling at different points along the seed-box a more representative sample from all levels would be obtained. Approximately, a 2 lb. sample was taken each time. At the time of sampling a questionnaire was taken (see Appendix). The purity analysis, weed seed count and germination techniques, were designed to approach as nearly as possible those laid down by the United States Department of Agriculture (2).

Purity Analysis, Weed Seed Count, and Germination

Bushel weights were run on all samples. Then by using a Boernor divider, the two pound sample was divided down to give a 500 gm. sample. From this a 100 gram. sample was obtained by further division. This was used for the purity analysis, the remaining 400 grams being used in total and noxious weed seed counts. The four components of a purity analysis (i.e. crop seed, inert matter, other crop seed and weed seed) were separated out and the percentages by weight recorded. To facilitate the separation of inert matter and weed seeds a South Dakota Seed Blower was used. To obtain a total weed seed and noxious weed seed count the numbers obtained in the 100 gm. and 400 gm. sample were combined. Weed seeds were identified to species.

Germination studies were carried out on all samples, with four replicates of 100 seeds from each sample.

Summary of Results and Conclusions

An investigation of a preliminary nature was carried out to examine the quality of oat seedings in New York State. The principal points under consideration were the weed seed content and the efficiency of cleaning equipment.

The results of a questionnaire taken from each farmer would suggest that the main practice in the county sampled was to sow home-grown seed and have it cleaned by a commercial cleaning plant. Treatment with organo-mercuric compounds for control of seedling diseases is usually included with the cleaning operation. Much of the home grown seed originally came from certified stock, the number of years from certification ranging from 1 to 4. At least 75 per cent. of the farmers in the survey were sowing currently recommended varieties.

Tables were presented showing the quality analysis for each sample. The total number of weed seeds and the number of noxious weeds per pound were recorded and these results were also expressed as the number of weed seeds added to the soil at a normal sowing rate of 2 bushels of oats per acre. Fifty per cent. of the cleaned samples had a total weed seed content ranging from 0 to 30 weed seeds per pound. Forty-three species representing 14 Natural Orders were identified. Fifteen crop species other than oats were also present.

Samples of certified seed taken in the survey showed better quality and fewer weed seeds than samples which had been cleaned by commercial plants or farm fanning-mills. The information on the tags for certified samples was taken and compared with the data obtained in the present study. The results were seen to be similar and within the tolerances allowed by the United States Department of Agriculture (2), and helped as a check on the technique adopted in this study.

The most frequent species in the cleaned samples were Yellow Foxtail (*Setaria glauca*), Couch Grass (*Agropyron repens*), Barnyard Grass (*Echinochloa crus-galli*), Charlock (*Brassica sirapis*), and Curled Dock (*Rumex crispus*). The first three species are grasses and are at present difficult to control in small

grains, the other two are dicotyledons and can be controlled by translocated herbicides. All the seeds of the above weed species are difficult to remove by air blast as their specific gravity is of the same order as oats. With these difficulties in cleaning operations, more should be done in the destruction of weeds at their source; in other words, the aim should be to grow cleaner oat crops. On the other hand, the survey seemed to indicate that weed species most serious in legume seedings were not introduced by sowing cleaned oat seed.

Examination of samples of uncleaned oats revealed a high weed seed content. The most frequent weeds were the same as those in the cleaned samples, though a higher proportion of lighter seeds such as Lambsquarters (*Chenopodium album*) and Green Foxtail (*Setaria viridis*) was noted in some samples. These uncleaned samples could be considered representative of what farmers use for feeding purposes, and it is pointed out that many of the seeds present may remain viable after grinding and passage through the intestinal tract of animals.

By applying the Canada Seed Law for commercial seed it was shown that 65% of the samples would have been classed "rejected" in Canada because of weed seed content.

It is suggested that the reporting of total numbers and species of weed seeds present would be of more practical interest to the farmer than a mere percentage of weed seeds by weight. This has also been pointed out by Dales (10).

Further work on a wider scale and including forage crops would be of value in determining the general quality of all seed sown by farmers. If germination and viability studies were added to the foregoing it might be able to forecast and obviate the main weed problems in New York rotations.

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AppendixQuestionnaire used for Small Grains

Name Address

County Date

Crop Variety Total area to be seeded

Rate of seeding

Certified Seed Commercial Bought from dealer Who?

Home Grown Bought from neighbour Who?

Is source of seed usual one used?

Cleaned by farm fanning mill Cleaning Plant Not Cleaned

Seed treated Or not?

If Home Grown

Sprayed against weeds When With Rate

Was crop badly infested with weeds What were the main ones

Rotation Estimated Yield

Remarks