

WEEDS OF WINTER WHEAT FIELDS IN SASKATCHEWAN - SURVEY RESULTS
FROM 1985 AND 1986

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The objective of the field survey was to identify and quantify the weed problems which exist in winter wheat fields at the present time. Because no previous weed survey data existed for winter wheat in Saskatchewan, the establishment of a data base to which future weed survey results can be compared was a logical first step. The 1985 survey was the first of four consecutive surveys planned for the province.

The survey covered the whole of the cultivated area of the province. Several methods were used to locate fields seeded to winter wheat. A majority of the locations were obtained from local elevator agents. Some of the surveyed fields were the same as those used for the survey to determine the incidence and severity of diseases on winter wheat. Locations for a few of the fields were provided by provincial extension staff. The remainder of the fields were located by chance while surveyors were on their way to known sites.

The locations of winter wheat fields were not evenly distributed throughout the province. The largest number of sites were on black soils for the 1984-5 survey and brown soils for the 1985-6 survey (Table 1).

TABLE 1. The number of fields surveyed on each of the major soil types in the province

| Soil | 1984-5 | 1985-6 |
|--------------------|--------|--------|
| Brown | 61 | 228 |
| Dark Brown | 73 | 191 |
| Black | 103 | 67 |
| Dark Gray and Gray | 37 | 38 |
| TOTAL | 274 | 524 |

The survey was conducted July 8-19 during 1985 and July 4-24 during 1986. Staff hired under the weed component of the Federal Provincial Economic and Regional Development Agreement for winter wheat were seconded to the weed survey project for these periods during July. By surveying early in July, only those weeds which had escaped from cultural and chemical control and from the pressures of crop competition were counted. These surviving weeds may have contributed to a yield loss and will have produced seeds to infest subsequent crops.

Once a surveyor arrived at a field, weed counts were obtained in 20 equally spaced 0.25 square metre (50 cm by 50 cm) quadrats. The quadrats were arranged in an inverted "W" pattern. The survey crew recorded 93 species as weeds of winter wheat fields during the 1985 survey and 88 species during the 1986 survey. A majority of these species occurred in less than 10% of the fields. A comparison of the two lists indicated however that 82% of the weeds were the same. Those species which were found on only one list occurred in only one or two fields and at very low densities.

Growers across the province were faced with different weed problems and the nature of the problem differed between years (Table 2). The results indicated that growers on brown soils had only three species per field with which to contend and this was reflected in a small average weed density in a field. In addition, over one-half of the quadrats surveyed on the brown soil were free of weeds. In contrast, northern growers on the dark gray and gray soils faced a much greater diversity of weed problems. The higher number of species resulted in high densities in the majority of the quadrats surveyed. The differences between the south and north were largest for the 1984-85 survey. The weed problems were more or less similar on the brown, dark brown and black soils during 1985-86 based on these three general characteristics. The differences between the years were likely related to variations in crop establishment, degree of winter damage and crop competitiveness.

TABLE 2. Three general characteristics of the weed problems found on the four major soil types in the province.

| Characteristic | Survey year | Brown | Dark Brown | Black | Dark Gray and Gray |
|--|-------------|-------|------------|-------|--------------------|
| Average number of species per field | 84-85 | 3.5 | 5.0 | 7.5 | 10.5 |
| | 85-86 | 3.2 | 3.2 | 3.3 | 7.6 |
| Average weed density (number per square metre) | 84-85 | 14.4 | 32.8 | 51.2 | 76.8 |
| | 85-86 | 26.0 | 25.9 | 37.8 | 79.9 |
| Weed free quadrats (%) | 84-85 | 56.0 | 40.8 | 25.2 | 8.8 |
| | 85-86 | 56.5 | 58.2 | 62.8 | 28.4 |

Abundance was used as a relative measure of the combined occurrence and density of a species. The sum of the relative abundance values for all the species in a survey is 300. By dividing the weeds into various groups using relative abundance, the contribution of the groups can be compared (Table 3). The annual and perennial grasses contributed the largest amount to the total relative abundance value for both years. The next largest group of species was the winter annuals and biennials. The group of weeds not controlled with phenoxy herbicides contributed more to the total relative abundance value than the group controlled with phenoxy herbicides. The last major group in terms of relative abundance was the perennial broadleaf weeds. These five groups accounted for nearly all the relative abundance value but represented only one-third of the species. The

TABLE 3. The relative abundance of six weed groups

| Weed Group | 1984-5 | 1985-6 |
|---|--------|--------|
| Annual and perennial grasses | 108.7 | 124.6 |
| Winter annuals and biennials | 59.4 | 56.0 |
| Annual broadleaf weeds not controlled by phenoxy herbicides | 64.1 | 42.1 |
| Annual broadleaf weeds controlled by phenoxy herbicides | 28.5 | 44.1 |
| Perennial broadleaf weeds | 25.8 | 17.4 |
| All other species * | 13.5 | 15.8 |
| TOTAL | 300.0 | 300.0 |

* There are 52 species in this group in 1984-5 and 50 species in 1985-6.

remaining two-thirds of the species contributed a relatively small amount to the total relative abundance for the survey. There were differences between years in the relative contribution of the six groups. These differences were mainly a reflection of the different distribution of fields sampled in the two surveys as illustrated in the following tables which consider the major species on the brown and black soils in the province.

The ten most abundant species found in the fields on the brown soils were very similar for the two years of the survey (Table 4). Eight of the ten species were common in both years. Cow cockle and lamb's-quarters did not rank in the top ten species in 1985-6 and thyme-leaved spurge and foxtail barley did not rank as high in the 1984-5 survey. Four of the twelve species in Table 4 are grasses and they represent a major component of the weed flora in winter wheat fields on the brown soils. There were no perennial species among the top ten and only two of the species, flixweed and stinkweed were winter annuals. In general the top ten species were slightly more frequent in 1984-5 than in 1985-6. The major exception was for green foxtail which was less frequent in 1984-5. The other major shift in the frequency occurred with wild oats which dropped in 1985-6. However, the average density for most species increased in the 1985-6 survey except for volunteer wheat which decreased significantly. The reason for the shifts in the frequency and density of the grassy weeds cannot be clearly identified but climatic differences between the two growing seasons certainly were important factors.

Table 4. The frequency and average field density of the ten most abundant species found on the brown soils of southwest Saskatchewan

| Species | Frequency (%) | | Density (no./sq.m) | |
|---------------------|---------------|--------|--------------------|--------|
| | 1984-5 | 1985-6 | 1984-5 | 1985-6 |
| Wild oats | 67.2 | 36.4 | 7.1 | 16.8 |
| Green foxtail | 26.2 | 39.5 | 12.9 | 29.5 |
| Volunteer wheat | 18.0 | 14.0 | 16.4 | 2.1 |
| Flixweed | 27.9 | 29.8 | 3.4 | 3.3 |
| Wild buckwheat | 34.4 | 36.4 | 1.6 | 2.7 |
| Stinkweed | 29.5 | 18.0 | 1.1 | 2.2 |
| Russian thistle | 19.7 | 18.4 | 2.4 | 6.9 |
| Kochia | 18.0 | 11.8 | 1.1 | 1.5 |
| Cow cockle | 8.2 | (1.3) | 4.1 | (2.9) |
| Lamb's-quarters | 11.5 | (7.9) | 0.7 | (2.0) |
| Thyme-leaved spurge | (4.9)* | 6.6 | (1.1) | 16.5 |
| Foxtail barley | (11.5) | 10.5 | (0.2) | 4.3 |

* A value enclosed in parentheses indicates the species was not among the ten most abundant weeds for that year.

The ten most abundant species on the black soils were very similar for the two years of the survey (Table 5). Eight of the ten species were common in both years. Hemp-nettle and lamb's-quarters did not rank among the top ten species in 1984-5 and flixweed and bluebur did not rank as high in the 1985-6 survey. Seven of the species that were abundant on the black soils were also abundant on the brown soils in the province. The abundance of the two perennials, Canada thistle and sow-thistle, on the black soils was one of the major differences between the weed flora on the two soil types. The abundance of the winter annual species (shepherd's-purse, stinkweed, flixweed and bluebur) was also greater on the black soils.

The frequency of species on the black soils was significantly less in 1985-6 than in 1984-5 (Table 5) The average reduction in frequency between the years was 57%. All species occurred less frequently. The reduction in frequency may be due to the establishment of a good competitive crop which suffered little winter damage. The average density of the two grass species increased significantly even though they occurred less frequently. The density of the four winter annual species was either equal or less in 1985-6. Three of the broadleaf weeds, Russian thistle, hemp-nettle and lamb's-quarter, occurred at much higher densities in 1985-6.

TABLE 5. The frequency and average field density of the ten most abundant species found in the black soils of Saskatchewan

| Species | Frequency(%) | | Density(no./sq.m) | |
|-----------------------|--------------|--------|-------------------|--------|
| | 1984-5 | 1985-6 | 1984-5 | 1985-6 |
| Green foxtail | 61.2 | 20.9 | 22.5 | 30.6 |
| Wild oats | 74.8 | 43.3 | 14.4 | 33.6 |
| Wild buckwheat | 77.7 | 28.4 | 9.4 | 5.7 |
| Shepherd's-purse | 27.2 | 13.4 | 15.4 | 15.4 |
| Stinkweed | 48.5 | 14.9 | 3.6 | 3.2 |
| Perennial sow-thistle | 31.1 | 11.9 | 4.7 | 4.8 |
| Canada thistle | 36.9 | 10.4 | 1.7 | 2.3 |
| Flixweed | 35.0 | (4.5) | 2.0 | (0.4) |
| Russian thistle | 24.3 | 7.5 | 6.0 | 25.6 |
| Bluebur | 26.2 | (10.4) | 3.2 | (0.9) |
| Hemp-nettle | (13.6)* | 13.4 | (4.3) | 23.2 |
| Lamb's-quarters | (28.2) | 16.4 | (1.4) | 10.9 |

* A value enclosed in parentheses indicates the species was not among the ten most abundant weeds for that year.

The majority (87%) of the herbicide treatments were applied in the spring. The high relative abundance of the winter annual group of weeds would suggest that fall application may have to be considered. The most frequently used herbicide was 2,4-D applied alone in the spring. As a group, the phenoxy herbicides were used on more than one-half of the treated acreage (Table 6). A significant percentage of the surveyed acreage on the brown soils was treated with chlorsulfuron rather than with a phenoxy herbicide. The dicamba and bromoxynil herbicides were used on about 20% of the treated acreage on all soil types in the province. A very small percentage of the acreage received a herbicide treatment that would control wild oats or green foxtail. As indicated previously these two annual grasses were the most abundant species found in the survey.

TABLE 6. Type of herbicide used by soil type for weed control in the 1985-6 winter wheat crop. Values are expressed as a percentage of the total acreage treated with these types of herbicide.

| Type of herbicide | Brown | Dark Brown | Black | Dark Gray or Gray |
|-----------------------|-------|------------|-------|-------------------|
| 2,4-D or MCPA | 57 | 78 | 69 | 73 |
| Dicamba or bromoxynil | 21 | 16 | 19 | 23 |
| Chlorsulfuron | 19 | 5 | 3 | 0 |
| Grassy weeds | 3 | 1 | 9 | 4 |

Growers indicated that the same five weeds were the most troublesome during both survey years although they were in a different order (Table 7). It is interesting to note also that

the species considered troublesome by the growers were the same as those which ranked high in the field survey. Two species were annual grasses, two species were winter annuals and the third was wild buckwheat. These species were the major components of the first three weed groups listed in Table 3.

TABLE 7. The five weeds considered most troublesome by growers during the two years of the survey.

| Species | 1984-5 | | 1985-6 | |
|----------------|----------------|----------------|----------------|----------------|
| | Severity score | Rank in survey | Severity score | Rank in survey |
| Flixweed | 284 | 7 | 547 | 6 |
| Wild oats | 247 | 1 | 905 | 2 |
| Wild buckwheat | 157 | 3 | 370 | 3 |
| Stinkweed | 148 | 4 | 372 | 5 |
| Green foxtail | 144 | 2 | 648 | 1 |

The two years of survey data have given a reasonably good idea of the species which were most abundant in winter wheat fields. However an unusually severe winter, a summer drought and a very wet fall during the two year survey period have all affected the weed populations, the competitiveness of the crop and the acreage seeded. These difficulties have also meant that areas within the province have been unequally sampled. These factors will have to be considered in planning the surveys during the next two years.

Wild oats and green foxtail appear to be major weed problems. Results from the field survey indicated these species were the two most abundant weeds. They were ranked among the top five most troublesome weeds by the producers in both years. Yet only a very small percentage of the acreage was treated with a grassy weed herbicide. The competitive effect of these species on yield is not known. This is an important aspect of the winter wheat weed problem that will be considered during the next two years.