Weed Management Systems in Spring Wheat. R.E.Guitard and F.A.Holm. University of Saskatchewan, Saskatoon.

Abstract

Trials were conducted at two locations near Saskatoon during 1989 to compare the effectiveness of three weed management systems in spring wheat. A conventional weed management system (pre and post emergent herbicides plus tillage) was compared to a conservation weed management system (herbicides and no tillage) and a cultural system (tillage and no herbicide). Each system was used in Katepwa spring wheat seeded at early (May 11) and late (May 29) seeding dates. Herbicides applied prior to crop emergence were pre-selected. Post-emergent herbicides were selected on the basis of the weed populations at each site. The Kernen site was a heavy clay soil which had been summerfallowed the previous year. The Sutherland site was a clay loam soil which was seeded to wheat during 1988. A heavy population of green foxtail (*Setaria viridis*) dominated the Sutherland site. The Kernen site had a light population of annual broadleaved weeds. Average grain yields at both sites were in the range of 2000 kg/ha. However, none of the three managment systems resulted in increased grain yield. Early seeding resulted in significantly higher weed populations and grain yields at both sites. The average cost of seedbed preparation and weed control operations showed that the conventional, conservation and cultural systems ranked from highest to lowest, respectively. In the absence of a yield response to any system during 1989, the check plots produced the highest net return.

Introduction

Wheat has been the major crop grown in Western Canada during this century. Spring wheat was sown over 10 - 11 million hectares of land in Western Canada, during 1988 and 1989. Of this total, close to 6 million hectares was sown to spring wheat in Saskatchewan (Anonymous, 1988 and 1989).

The value of wheat has been low during this period while input costs have remained high. Major input costs were weed control and seedbed preparation. As the return/cost ratio decreases, the amount of weed control declines and weed populations increase. O'Donovan (1988), reported that wild oat populations in wheat increased when not controlled and that the best return was achieved with yearly control. Sharma and Vanden Born (1983), showed that crop competition was important in reducing weed biomass and aiding herbicide efficacy.

Weed control must be an ongoing part of sound management practices. Some short term conditions may necessitate lessened weed control, but long term production requires a suitable management system. Many combinations of management practices effectively control weeds. Some of these practices favour tillage, (Malhi et al. 1988), while others favour herbicide and reduced tillage (Lybecker et al. 1988). Management systems generally serve the needs of producers best in their own areas. Multiple systems, however, must be evaluated together in order to determine relative performance for a particular area. Therefore, a study was initiated to assess the relative agronomic, weed control and economic potential of three weed management systems for spring wheat grown near Saskatoon.

Materials and Methods

To realize the objectives of the study, an experiment utilizing 7 treatments grouped into three management systems, two seeding dates and two locations was set up near Saskatoon. The locations were the Kernen Crop Research Farm and an adjacent parcel of land designated Sutherland East. These locations represented two soil types and crop histories. The Kernen site was on a five year rotation of fallow - weed plots - crop - crop - crop. This site was used for the fallow treatments. The soil was a clay loam with a high potential water holding capacity. When tested in late April, the soil moisture content was 23% w/w. The fertility was excellent with 100 kg/ha residual NO3-N to a depth of 60 cm. The soil profile was

uniform with the A horizon thinning rapidly to the S.E., where a small knoll was present. The Sutherland East site was chosen for the wheat stubble treatments. It was seeded to Katepwa wheat during 1988. The Sutherland site has had a rotation of crop - fallow - crop since being aquired by the university. The soil was a clay loam with good potential water holding capacity. When tested in late April, the soil moisture content was 21% w/w. The fertility was adequate with 50 kg/ha of residual NO3-N to a depth of 60 cm. The soil profile was variable with the A horizon thinning toward the S.E.. The factorial experiment consisted of two dates of seeding, May 11 and May 29 and 7 treatments. These treatments are summarized in Table 1. Treatments were applied to 5 x 10m plots of solid seeded Katepwa spring wheat. The treatments were replicated 4 times in a randomized complete block design.

Table 1. Weed management treatments applied to Kernen and Sutherland plots, 1989.

System	Seeding Date	Treatment
1. Conventional	May 11 (early) May 29 (late)	pre-emerge triallate+trifluralin post-emerge herbicide
2. Conventional	early late	post-emerge herbicide same
3. Check	early late	no weed control same
4. Cultural	early late	post-seeding rodweeding tyne harrow crop 3-4 leaf
5. Cultural	early late	tyne harrow crop 1-2 leaf same
6. Conservation	early late	fall 2,4-D, spring glyphosate post-emerge herbicide
7. Conventional	early	fall triallate+trifluralin fall 2,4-D, post-emerge herbicide

The weed spectrum of each site was evaluated in order to determine the preferred post-emerge herbicide. These chemicals, their rates and date of application along with the weed/crop stage are summarized in Table 2. The weed spectrum at Kernen was dominated by annual broadleaved weeds and at Sutherland by grassy weeds.

Table 2. Herbicidal chemicals applied to weed management systems at Kernen and Sutherland, 1989.

System	Herbicide	Date Applied	Rate(L/ha) Applied	Weed/Crop Stage
Conventional	triallate+trifluralin	May 18+ May 31	1.4+0.6 (kg/ha)	seedling/pre
	bromoxynil/MCPA(Kernen)	May 31	0.5	1-2/2-3
		June 30	1.0	2-3/3-4
	propanil (Sutherland)	May31	1.4	2-3/3-4
		June 30	2.8	2-3/3-4
	2,4-D amine(Sutherland)	May 31	0.6	1-2/2-3
		June 30	1.1	2-3/3-4
	2,4-D LV ester (Suther)	Oct.20/88	0.7	rosette
	triallate+trifluralin	Oct.5/88	1.1+0.44 (kg/ha)	
Conservation	glyphosate	May18 May31	1.0	1-2/pre
	2,4-D LV ester	Oct.20/88	0.7	rosette
	bromoxynil/MCPA(Kernen)	May 31	0.5	1-2/2-3
		June30	1.0	2-3/4-5
	propanil (Sutherland)	May 31	1.4	1-2/2-3
		June 30	2.8	2-3/3-4
	2,4-D amine(Sutherland)	May 31	0.6	1-2/2-3
		June 30	1.1	2-3/3-4

The plot area for the fall applied treatments was tyne harrowed twice to incorporate the granules. The entire plot area excluding the conservation treatments was tilled with a field cultivator.

The area was lightly cultivated immediately prior to seeding. A double-disc press drill was used to solid seed the 5 x10m plots. Fertilizer, 11-55-0, was applied with the seed at a rate of 50 kg/ha. Other equipment included a hooded CO2 plot sprayer, 3.5m rodweeder, 4m tyne harrow and a 1.25m plot harvester.

Results and Discussion

The Kernen site was dominated by annual broad-leaved weeds and low wild oat counts. The weed spectrum consisted of wild mustard (*Brassica kaber*), redroot pigweed (*Amaranthus retroflexus*), wild buckwheat (*Polygonum convolvulus*), stinkweed (*Thalaspi arvense*), lamb's quarters (*Chenopodium album*), russian thistle (*Salsola tenuifolia*) and wild oat (*Avena fatua*). Comparing management systems for final weed density showed that, while the check treatment had more weeds, there were no differences between systems. Grain yields at Kernen were not affected by management system and were not significantly different from the check. The mean yield of each system was close to 2000 kg/ha. Comparing the weed with the yield data suggests that some overriding factor(s) exerted a greater influence than the treatments.

The Sutherland site was dominated by green foxtail (*Setaria viridis*). Other minor species included wild oat and annual broad-leaved weeds. Grain yields were not affected by management system.

The mean yield of each system was close to 2000 kg/ha. As with the Kernen site, another factor(s) exerted a greater influence than the treatments.

As part of the experiment, the effect of seeding date on each treatment was evaluated. Differences in weed density between sites were evident, with the Sutherland total being much greater. At the Kernen and Sutherland sites, the early seeding (May 11) resulted in significantly higher weed density and yield than the late seeding date (May 29).

Environmental data (not presented) showed that while 10cm of precipitation was received during May 89, moisture stress was prevalent the remainder of the season. This stress limited the crop response to the applied treatments resulting in few significant interactions. The heat stress encounterd during 1988 was noticably reduced during 1989.

The economics of these management systems were evaluated by determining the cost of seedbed preparation and weed control measures. Table 3 shows the results of the preliminary economic evaluation of the management systems at Kernen and Sutherland.

Table 3. Effect of management system on economic evaluation of weed control measures at Kernen and Sutherland, 1989.

System	Cost ($/ha) Seedbed	Weed Control	Total ($/ha)
Conventional	47.37	36.56	83.93
Conservation	22.04	44.62	66.66
Cultural	47.37	10.40	57.77
Check	47.37	0	47.37

Comparing the lack of weed or yield response with the high cost of weed control and low crop prices showed conclusively that utilizing no weed control provided the highest net return for 1989.

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