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CHEMICAL CONTROL OF WEEDS IN SOYBEAN (*Glycine max*. L.)

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ABSTRACT

Experiments on chemical weed control in soybean (Glycine max. L.), were conducted during 1997 and 1998 at Agricultural Research Station, Mingora (Swat). The soil was loamy clay with pH of 7.5, organic matter of 0.9% and EC dsm-1 was 0.15. Mingora is mild cold in winter and mild hot in summer. Herbicidal treatments consisted of Ipiflour-48 EC @ 4 L, Dual gold-5000 EC @ 3 L, Stomp 330 E @ 3.5 L, Sencor-70 WP 3.5 1 Kg and Racer 25 EC @ 2.5 L ha-1. Hand weeding and unweeded checks were also included. All herbicides were used as pre-emergent sprays. Weber variety of soybean was planted during both the years 1997 and 1998. In 1997, planting was done on June 6 and on July 11 in 1998. Herbicides were applied the same day after planting each year. All herbicides controlled weeds during both the years and increased the soybean yield significantly over unweeded plots. Dual gold was the most effective herbicide in increasing soybean yield followed by hand weeding and Ipiflour 48 EC with 4043, 3345, and 3302 kg ha-1 yields, respectively during 1997. Stomp 330 E and Sencor-70 WP were statistically similar with 3181 and 3050 kg ha-1 yield respectively. Herbicide Racer 25 EC was the least effective treatment in 1998, while Ipiflour 48 EC and Dual gold 500 EC were the best treatments with 2000 and 1950 kg ha^{-1}, respectively. Soybean yield in 1998 was lower in all treatments than in 1997 perhaps due to delayed planting during 1998. Regression and correlation analysis for each year indicated negative values (-5.38 and -5.34) suggesting a very clear effect of weeds on soybean yield during 1997 and 1998, respectively. In either year R2 of 0.286 and 0.304 suggested that weeds reduced crop yield by about 30% each year.

Key words: Soybean *Glycine max* L. weed management Ipiflour Stomp 330E Dual Gold yield

INTRODUCTION

Soybean *(Glycine max.* L.) is an annual summer legume. It is an important source of high quality, inexpensive protein and oil. With 38% protein content, soybean has the highest protein content of all food crops and is second only to groundnut in terms of oil content (18%) among the food legumes. In some respects, legumes have already achieved star status in the crop world. They play a huge role in feeding the world's people and animals, particularly in third world countries, where they meet as much as two thirds of human nutritional needs. Moreover, because they can pull nitrogen out of the air, they do not need much chemical fertilizers. That makes legumes as bargain for poor farmers who cannot afford fertilizers and a boon to richer ones whose overuse of farm chemicals can lead to water, soil and air pollution. Soybean is highly sensitive to the length of day. Therefore, the grain size and yield of a variety is largely determined by the

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number of days it has to grow before a certain length of day forces its maturity (Pergus and Hanmond, 1958).

Pakistan including North West Frontier Province faces an acute shortage of edible oils because domestic production is far below the consumption thus the country imports a huge amount of oilseeds/vegetable oil from abroad with an annual expenditure of more than Rs. 40 billions. Soybean is major crop grown for oil extraction worldwide. However, in Pakistan, soybean production is very limited and restricted to NWFP (Anonymous, 2002). If proper attention is paid, its area and production can be boosted with great benefits to NWFP. Weeds are one of the production constraints that reduce the yield. In soybean, yield losses of 20 to 80% have been reported depending on weed species and crop varieties, density of weeds and crops stage, weeds and crop emergence and weather conditions (Richard, 1984).

Aslam and Mirza (1988) reported soybean loses of about 50% due to weeds. Ghafoor, et al. (1990) reported that combination of fluazifop butyl and Fomasafen proved excellent in controlling all the classes of weeds and increasing soybean yield. In another study, Shafiullah *et al.* (1990) reported increases in yield to the extent of 123, 105, 111 and 92% by application of pendimethalin, oxadiazon, trifluralin and fluazifop butyl, respectively. Weed density was decreased 96, 92, 90, 88 and 85% by application of hand weeding, pedimethalin, trifluralin, oxadiazon and fluazifop butyl, respectively. Kapusta (1979) demonstrated that oryzalin and cyanazine applied as preplating controlled more than 90% of giant foxtail. Rao (1992) recommended alachlor (1.5 to 3.0 kg ha^{-1}), chloromben (1.0 to 2.0 kg ha^{-1}) chlropropham (1.5 to 2.5 kg ha^{-1}), linuron (1.5 to 2.0 kg ha^{-1}), flurodifen (2.0 to 3.0 kg ha^{-1}), metribuzin (1.5 to 2.5 kg ha^{-1}), qxadiazon (1.5 to 2.0 kg ha^{-1})and propachlor (2.0 to 3.0 kg ha^{-1}) for weed control in soybean. Further studies by Balyan et al. (1999) reported from Hisar, India exhibit that pre emergence application of alachlor at 1.5 and 2.0 kg ha^{-1} gave a 70 to 95% control of broad leaf and grassy weeds. Similarly, acetachlor and chlorimuron at 750g + 8g or 1000g + 8 g gave 75-95% control of both types of weeds. All treatments enhanced soybean yield. Foloni and Christoffoleti (1999) from Brazil reported carfentrazone + chlorimuron ethyl gave 80 to 90, 93 to 100 and 90 to 100% weed control in soybean. Peneva (1997) from Britain reported that in soybean, fluazifop-p butyl was effective but acetochlor + lactofen with imazethapyr, Fomasafen and bentazone with Lutensol (wetter) were the most effective treatments. Keeping in view the importance of soybean into the economy of Pakistan and weeds to the soybean production studies were undertaken to investigate effective and economical herbicide(s) for soybean under the prevailing agroecological conditions of Swat, Pakistan

Materials and Methods

Field trials were conducted at Agricultural Research Station (ARS), Mingora (Swat) during 1997 and 1998. Experimental field was loamy clay with a pH of 7.5 and organic matter of 0.90 and electrical conductivity (EC) dsm^{-1} was 0.15. Mingora is mild cold in winter and mild hot in summer. In both the years, treatments were Ipiflour 48 EC at 3.0 L, Dual gold 500 EC at 3.5 L, Stomp 330 E at 4 L, Sencor 70 WP at 1 kg and Racer 25 EC at 2.5 L ha^{-1} including hand weeded and un-weeded controls. All herbicides were applied pre emergence to the crop.

The experiments were laid out in randomized complete block design with three replications. Weber variety of soybean was planted on June 6, 1997 and on July 11 in 1998. The distance between rows was kept 45 cm apart with a seeding rate of 100 kg ha^{-1}. Plot size was 2.25 x 4 m^{2} with five rows per plot each year. Nitrogen as urea at 50 kg ha^{-1} and phosphorus as P_2O_5 at 75 kg ha^{-1} were applied. All herbicides were applied as

pre-emergence sprays on the same date, after the planting of the experiment. Herbicides were applied with knapsack sprayer fitted with 4 T jet nozzles adjusted at a distance of 45 cm between nozzles. Water at 200 L ha^{-1} was used as carrier at 40 lbs psi after proper calibration. Hand weeding to requirement was done at appropriate times. Un weeded plot remained weedy for the whole season. Data were recorded on weed density and soybean yield. In 1997, weed density data were recorded on July 17 and in 1998 on August 22. Weed density was obtained by counting various species of weeds separately in a quadrate (1 m^2). In each treatment, three quadrates (1 m^2) were placed randomly and weed density was averaged per m^2. Seed yield per plot was obtained by harvesting when most soybean plants turned yellowish. After air drying the samples were threshed and seed weight was obtained after drying to 14% moisture level. Data on weed densities and seed yield were analyzed and means were separated by LSD test using computer based MSTATC software program. Regression and correlation analysis was also run for determination of the effects of weeds on soybean yield (Steel and Torrie, 1980).

Results And Discussion

The results indicated that during both the years *Brassica kaber*, *Digitania sanguanalis*, and *Echinochloa colona* were the major weed species, while *Chonopodium album* and *Cyperus rotundus* were prevailing during 1997 (Table-1), whereas *Digeria arvensis and E.Crusgalli* were noted during 1998 (Table-3). Weed species and density is affected certainly by the site as well the time of soil preparation and crop planting at different dates. In the year, 1997, soybean was planted earlier on June 6 and in 1998, soybean was planted late on July 11. Therefore, species reported during the two years were different. During both the years, herbicides significantly reduced the weed densities and were al par with each other. In 1997, weed density in unweeded plot was 63 and 2 to 12 in the herbicide treated plots (Table-2). In 1998, weed density in the unweeded plot was 61 compared to 4 to 8 in the herbicide treated plots (Table-4). This suggested that all herbicides used in the study were equally effective for weed control in soybean and could be used depending on the availability and price of individual herbicides. However, Dual gold 500 EC seemed to be the most effective in controlling soybean weeds and increasing its yield. Dual gold 960 EC, a different formulation was reported by Khan and Vaqar (2003) a very effective herbicide in many crops. The results are also in agreement with other similar studies conducted by various researchers (Shafiullah et al 1990; Ghafoor et al. 1990;Kaspurtu, 1979; Baylan et al. 1999).

Effect of Herbicides on Soybean Yield

The results of the study (Tables-2 and 4) exhibit that during both the years soybean yield was significantly increased by herbicidal treatments. However, the yields were significantly different between two years. In the year 1998, yield was low compared to the year 1997 the reason could be the late planting of soybean in 1998. Yield was differently affected by the individual herbicides. Un weeded plot produced the lowest yield of 1177 kg ha^{-1} during the year 1997 and 578 kg ha^{-1} during the year 1998. Plots treated with Dual gold 500 EC produced the maximum yield of 4043 kg ha^{-1} followed by hand weeding, Ipiflour 48 EC, Stomp 330 E and Sencor 70 WP with 3345, 3302, 3181, and 3050 kg ha^{-1}, respectively. Herbicide Racer 25 EC was the least effective in increasing soybean yield in 1997. In 1998, weedy plot produced 578 kg ha^{-1}, Ipiflour 48 EC treated plot gave the maximum yield of 2008 kg ha^{-1} followed by Dual gold 500 EC with 1950 kg ha^{-1}. The yield loss during both the years was tremendous, which could be most probably

attributed to the fact that soybean fixes good amount of nitrogen from the atmosphere that could be utilized by the un removed weeds and caused severe losses. These two treatments (Ipiflour 48 EC & Dual gold 500 EC) were at par with each other, followed by Stomp 330 E and Sencor 70 WP treated plots. Racer 25 EC was again the least effective treatment. Hand weeding in most cases is not reliable because of weather in the summer season often does not allow proper weeding by hand, apart from being uneconomical.

Association of Soybean Yield to Weed Density

This relationship was determined by computing regression equation and presented in Figs 1 and 2. Regression and correlation analysis indicated that even though the yield in 1997 comparatively higher than the yield in 1998, even then the relationship between soybean yield and weed density were fairly similar. Values in both the years were more or less the same 359.06 and 360.97, b values were also not different from each other (-5.38 and -5.34). The negative sign suggested that increasing weed density decreased soybean yield in both the years, and similar values during both the trials suggested that yield of soybean could be similar under the prevailing environment. The Coefficient of determination (R^2) values (0.286 and 0.304) for both the years were similar that suggested in this particular study that weed reduced the soybean yield by about 30%.

Conclusions

Most herbicides were effective in controlling weeds and increasing soybean yield. In comparison with manual weeding, herbicides application is feasible and less expensive and therefore recommended for adoption.

Table-1. Weed density as affected by different herbicides in soybean during 1997

Name of Weeds	Weedy Control	Lpiflour-48 EC	Dual gold 500 EC	Stomp 330 E	Sencor 70 WP	Racer 25 EC	Hand Weeding
Brassica kaber	8	1	0	2	0	1	1
Chenopodium album	8	1	1	1	0	0	2
Cyperus rotundus	11	1	0	9	3	6	3
Dactyloctenium acgyuptium	3	0	0	0	0	0	0
Digitaria sanguinalis	10	0	1	0	0	1	0
Echinochloa colona	17	0	0	0	0	1	1
Eleusine indica	5	0	0	0	0	1	1
Trianthema monogyna	2	0	0	0	0	0	0
Total	64	3	2	12	3	10	8
$LSD_{0.05}$	13.2						

Table-2. Soybean yield as affected by different herbicides in 1997

Treatment	kg ha^{-1}	Increase Yield over control (%)
Weedy control	1177 d	--
Lpiflour 48 EC	3302 b	180
Dual gold 500 EC	4043 a	243
Stomp 330 E	3181 b	170
Sencor 70 WP	3050 b	159
Racer 25 E	2592 c	120
Hand Weeding	3345 b	184
$LSD_{0.05}$	327.0	

Table-3. Weed density as affected by different herbicides in soybean during 1998

Name of Weeds	Treatments						
	Weedy Control	Lpiflour-48 EC	Dual gold 500 EC	Stomp 330 E	Sencor 70 WP	Racer 25 E	Hand Weeding
Brassica kaber	10	1	1	3	0	1	3
Cynodon dactylon	1	1	2	2	0	4	1
Digeria arvensis	11	1	0	0	0	0	0
Digitaria sanguinalis	17	2	1	3	6	2	2
Dactyloctenium aegyptium	0	1	0	1	0	1	0
Echinochloa crus-galli	12	0	0	0	0	0	1
Trianthema monogyna	10	0	0	0	0	0	0
Total	61	6	4	9	6	8	7
$LSD_{0.05}$	27.0						

Table-4. Soybean yield as affected by different herbicides in 1998

Treatment	kg ha^{-1}	Increase Yield over control (%)
Weedy control	578 c	--
Lpiflour 48 EC	2008 a	247
Dual gold 500 EC	1950 a	237
Stomp 330 E	1510 b	161
Sencor 70 WP	1688 ab	192
Racer 25 E	1600 b	176
Hand Weeding	1784 ab	208
$LSD_{0.05}$	332.0	

Fig.1 Relationship of Weed Density Vs Soybean Yield in 1997

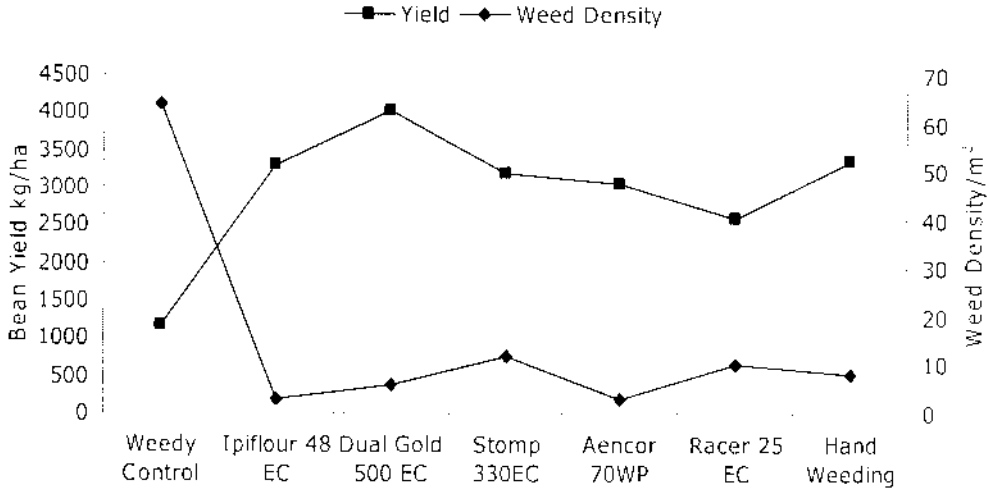
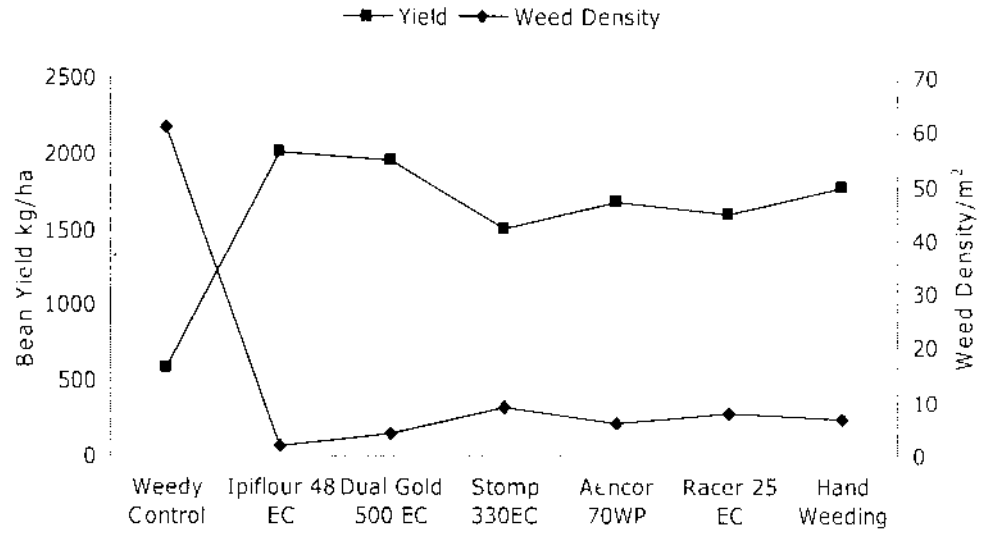


Fig.2 Relationship of Weed Density Vs Soybean Yield in 1998



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