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CHEMICAL WEED CONTROL IN CORN

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The effect of different herbicides like oliogesaprim 200Ec., Gesaprim 80 WP., 2,4-D 50 Ec, and Afalon 50 Wp., were investigated against the conventional and intensive cultural weed control practices, on the growth, grain yield and weeds of maize. The stand density and various yield components were adversely affected by the application of 2,4-D. The application of Gesaprim at pre-emergence appeared to be as effective as mechanical weeding in maize. Equally high grain yield of 20.68, 20.85 and 21.10 quintals per acre were obtained in pre-emergence gesaprim treated, normally and intensively hoed plots, respectively. Thus, the chemical weed control was found to be cheaper, more effective, less labourious and relatively more lasting as compared to mechanical weed control.

INTRODUCTION

The production of most crops involves a constant battle with weeds in addition to insect pests and diseases. Weeds not only reduce the crop yield, but also deteriorate the quality of farm produce, thereby, reducing its market value. Besides, they increase the cost of cultivation. The eradication of weeds from the crop fields is, therefore, very essential for obtaining a good crop and high cropping intensity. At present various types of cultural practices like hand weeding or interculture are being employed to eliminate weeds from the maize crop but they are very costly and time consuming. Chemical weed control is of recent origin and is being emphasized in modern agriculture. However, it has not been adopted so far on a commercial scale in our country. This seems to be an effective method and if found successful under our conditions it can help achieve a speedy break through in maize production. Jonas, *et al* (1955) observed that at high rate of fertilization with NPK, weeds competed strongly for essential nutrients, suppressed the growth of corn and resulted in decreased yields. Staniforth (1957) emphasized the importance of early foxtail control to insure a competitive advantage for corn, if early weeds not controlled.

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competition between corn and weeds for water and nutrients increased through out the season, resulting in reduction of corn yield. Sheet, *et al* (1962) reported that corn is very tolerant to atrazine but much less tolerant to some of the other striazines especially on calcarious soils. Burniside *et al* (1964) observed that hand weeding as compared with no weed control increased grain yield, sorghum height, seed moisture at harvest, individual head weight and decreased weed yield. Pre-emergence atrazine application @ 2 and 4 pounds per acre increased sorghum grain yield. Mazzoni and Scholl (1964) stated that alfalfa yields were significantly higher in plots with chemical rather than mechanical weed control. Dawson (1964) stressed upon the early removal of weeds which emerged soon after planting and caused extensive reduction in bean yields. Once beans reached sufficient height to provide shading, further competition from emerging weeds was reduced. Guneyli *et al* (1969) stated that there were significant losses in sorghum yield due to weeds. Brown and Beaty (1970) found that there were highly significant differences in yields among herbicide treatments. Wallace, *et al* (1970) concluded that atrazine was not toxic to corn on any of the soils at commercial application rates. The present study was planned with the object in view and particularly aimed at selecting suitable herbicide capable of weed control in maize crop on an economical basis.

MATERIALS AND METHODS

The investigations were carried out at the Maize and Millets Research Institute, Yousafwala (Sahiwal) during the autumn 1974. A commercial maize variety "Neelum" was used as medium of the trial. The crop was sown on July, 29 on a well prepared seed bed with a dibbler. The row to row distance was 27 inches and plant to plant 8 inches. The following treatments were tested in the study:

1. Oliogeasprim @ 2.00 pounds a.i. post emergence (atrazine).
2. Gesaprim @ 2.00 pounds a.i. per acre pre-emergence (atrazine).
3. Gesaprim @ 2.00 pounds a.i. per acre post-emergence (atrazine).
4. 2, 4-D @ 0.50 pounds a.i. per acre post-emergence.
5. Afalon @ 1.00 pounds a.i. per acre post-emergence.
6. Normal hand weeding.
7. Intensive hand weeding.
8. Control.

The experiment was laid out in a randomized complete block design with four replications. The net plot size was 1/176 acre. The crop was

fertilized with nitrogen and P_2O_5 at the rate of 120 lbs. and 60 lbs. in urea and triple superphosphate, respectively. All the phosphorus was side-banded at planting while nitrogen was applied in three i.e., 40 lbs. at sowing, 40 lbs. with the second irrigation and the remaining 40 lbs. with the fourth irrigation. The herbicides were applied at post-emergence (3 leaf stage) except Gesaprim which applied before-emergence also. The herbicidal spraying was done with the help of knap-sack sprayer fitted with three fan-ject nozzles on a specially made boom. The spraying volume at the rate of 350 litres of ordinary water per acre was used for spraying the chemicals.

In case of hand weeding treatments, hoeing was done with the help of ordinary hand hoe (Kasola) 2 to 4 times, according to the nature of the treatments. Two hoeings each after the first and the third irrigation, while four hoeings were given each after first four irrigations and was followed by earthing up.

In all, seven irrigations were given to the crop in addition to the natural precipitation of 2.00 inches, received during the growing period. The crop was treated once with Endrin spray at the early stage and twice with Diazinone granules against the insect pests. In order to minimise the masking effect of one weedicide on the other. The central three rows out of five were selected in each plot for observations. The crop was harvested in the second week of November. The data was statistically analysed by the analysis of variance method and the difference between the treatment means were tested by L.S.D. at the 5% of significance level.

RESULTS AND DISCUSSION

Plant growth

The Maize seedling showed differential effect (Table 1). Both the formulations of atrazine i.e., oliogesaprim and Gesaprim did not show any phytotoxicity to the seedling whereas the application of 2, 4-D resulted in the highest seedling mortality which was 21–27 per cent. A similar type of toxicity of 2, 4-D has been reported by Sheet, *et al* (1962) and Wallace, *et al* (1970).

The plant density at harvest varied significantly. The application of 2, 4-D at post-emergence resulted significantly lower stand than the rest of the treatments which were at par with one another. The results further indicated that due to the phytotoxicity of 2, 4-D, the percentage of barren or nubbin plants increased significantly. However, this sort of toxic effect was not observed

in other treatments. It was further observed that the percentage of fertile plants in these treatments was comparatively higher. It appears from the discussion that maize plants probably, do not have the capacity to detoxify the 2, 4-D absorbed by them, whereas other herbicides i.e., atrazine and afalon may be detoxified and hence do not harm the plants. Similar observations were made by Wallace, *et al* (1970).

Plant height and stem diameter

The plant height and stem diameter (Table 2) were affected significantly by the various treatments. Both the hand-hoed treatments produced significantly taller plants than in the case of herbicidal treatments. Application of oliogesaprim at post-emergence and Gesaprim before emergence increased the plant height significantly. Similarly stem diameter was observed to be significantly higher in intensively hoed and atrazine treated plants. However, the thinnest stemmed plants were obtained in the case of 2, 4-D treatment. It appears that the phytotoxic behaviour of 2, 4-D did not permit these plants to grow and develop fully. The results are in agreement with those of Jonas, *et al* (1955) and Burniside *et al* (1964).

Cob size

The application of atrazine formulations both the pre and post-emergence increased the cob size significantly over others except cultural treatments (Table 3). However, the cobs of the smallest size were obtained in plots treated with 2, 4-D which ultimately resulted in significantly lesser yield. The abnormalities observed in the 2, 4-D treated plants are attributable to its phytotoxic behaviour during the plant growth. These results are in agreement with those of Burniside, *et al* (1964).

1000-grain weight and grain yield per acre at 15% moisture level

Considering the 1000-grain weight (Table 4) significantly heavier grains were obtained from the hand-hoed plots than from the herbicidal treated plots including check. Within the herbicidal treatments, again the 2, 4-D treated plants produced the lightest grains which may be due to the reason that accumulation of 2, 4-D within the plant body adversely affected the synthesis of starch and/or its translocation into the grain. However, the lower grain weight in control plants, was probably due to the fact that there was hard competition between the crops plants and weeds for food and moisture etc., which ultimately affected the grain development potential of the plant. The results are in line with those of Jonas, *et al* (1955) and Burniside, *et al* (1964).

The data regarding the grain yield per acre (Table 4) showed that although the yield levels were fairly high in all the treatments, but it was significantly lower in 2, 4-D treated plots even than control. The highest yields of 21.10, 20.86 and 20.68 quintals per acre were obtained in intensviely hoed, normally hoed and pre-emergence Gesaparim treatments respectively, but the differences among them were non-significant.

Amongst the herbicidal treatments, the application of gesaprim both at pre- and post-emergence gave significantly higher grain yield per acre than all the others. The lowest grain yield in case of 2, 4-D seems to be due to the reason that all the yield components like cob size, grain weight etc., were adversely affected by its application. Moreover, 2, 4-D being a selective herbicide for broad-leaved weeds could not control all other weeds effectively which were abundant in number in the experimental plots. This situation led to hard competition between the crop plants and weeds for moisture and food nutrients which ultimately resulted in poor yield.

However, comparative low yield in the case of afalon application is attributable to its poor residuary effect on the weeds growth, which resulted in the establishment of high weed density at the later stages and thereby, increased the competition. The results are in confirmatory with Hay, *et al* (1950), Jonas *et al* (1955), Standforth (1957), Burnside, *et al* (1964) and Mazzoni and Scholl (1964), Dawson (1964), Guneyli, *et al* (1969).

It may be concluded that the application of Gesaprim at pre-emergence appeared to be equally effective as mechanical weeding in maize production and hence the chemical weed control which is comparatively cheaper was, more effective, less laborious to apply and long lasting. It can be safely adopted without adversely affecting the final yield of maize crop.

Table 1. *The effect of herbicide on plant growth*

Treatments		Seedling mortality percentage	Final plant stand (percent)	Percentage of nubbin plants
1. Oligesaprim	post-emergence	0.94 b	95.1 ab	0.79 b
2. Gesaprim	pre-emergence	0.78 b	95.30 ab	0.635 b
3. Gesaprim	post-emergence	0.78 b	95.00 ab	1.271 b
4. 2, 4-D	post-emergence	21.27 a	74.55 d	10.229 a
5. Afalon	post-emergence	1.26 b	93.79 abc	1.055 B
6. Normal hand weeding		0.94 b	92.73 bc	0.981 b
7. Intensive hand weeding		1.25 b	90.76 bc	0.999 b
8. Control		0.78 b	95.91 a	1.107 b
L.S.D. at 5%		2.99	3.05	1.72
L.S.D. at 1%		4.08	4.15	2.34

Table 2. *The effect of herbicides on the plant height and stem diameter.*

Treatment		Plant height (cm)	Stem diameter (cm)
1. Olio-gesaprim	post-emergence	226.75 b	2.10 ab
2. Gesaprim	pre-emergence	230.72 b	2.13 a
3. Gesaprim	post-emergence	219.00 c	2.08 abc
4. 2, 4-D	post-emergence	197.00 e	1.91 e
5. Afalon	post-emergence	210.50 d	2.02 ed
6. Normal hand weeding		240.00 a	2.05 bc
7. Intensive hand weeding		242.00 a	2.12 a
8. Control		209.75 d	1.97 de
L.S.D. at 5%		5.35	0.07
L.S.D. at 1%		7.28	0.16

Table 3. *The effect of herbicides on the cob size*

Treatment		Cob length (cm)	Cob diameter (cm)
1. Olio-gesaprim	post-emergence	17.95 ab	4.73 a
2. Gesaprim	pre-emergence	18.28 ab	4.73 a
3. Gesaprim	post-emergence	18.00 ab	4.68 d
4. 2, 4-D	post-emergence	10.85 e	3.35 d
5. Afalon	post-emergence	15.85 b	3.35 b
6. Normal hand weeding		17.60 b	4.63 a
7. Intensive hand weeding		18.50 a	4.83 a
8. Control		11.63 d	3.88 cd
L.S.D. at 5%		0.77	0.26
L.S.D. at 1%		1.04	0.35

Table 4. *The effect of herbicides on the 1000-grain weight and grain yield.*

Treatments		1000-grain weight (gms)	Grain yield quintals/acre
1. Oliogesaprim	post-emergence	252.87 c	19.72 c
2. Gesaprim	pre-emergence	254.39 b	20.68 ab
3. Gesaprim	post-emergence	252.87 c	19.85 bc
4. 2 4-D	post-emergence	227.24 f	12.38 f
5. Afalon	post-emergence	249.60 d	17.34 d
6. Normal hand weeding		255.52 a	20.85 a
7. Intensive hand weeding		256.08 a	21.10 a
8. Control		247.72 e	14.85 e
L.S.D. at 5%		0.54	0.87
L.S.D. at 1%		0.74	1.19

Table 1–4: Any two means not sharing a letter differ significantly.

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