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Effect of Doses and Times of application of 2, 4-D on Weed Control in 'Kalyansona' Wheat*

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ABSTRACT

An investigation was carried out during *rabi* of 1971-72 to study the effect of four doses (0·56, 1·12, 1·68 and 2·24 kg a e/ha) of 2,4-D at four times of application (full dose at 4 weeks, full dose at 6 weeks, ½ at 4 weeks + ½ at 6 weeks and ½ as pre-emergence + ½ at 4 weeks) in addition to hand weeding and an unweeded control. The results indicated the possibility of replacing the conventional practice of hand weeding by application of 2, 4-D @ 0·56 kg a e/ha at 4 weeks after sowing 'Kalyansona' wheat, when the crop receives two irrigations.

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INTRODUCTION

In Gujarat, wheat covers an area of 5·77 lakh hectares with a total production of 9·39 lakh tonnes. The farmers pay reasonable attention to its cultivation especially in respect of seed-bed preparation, manuring and irrigation after the introduction of high yielding dwarf wheat varieties. However, wheat being a close sown crop, it is not possible to carry out frequent hoeings to control weeds. The common practice of hand weeding is slow, labour intensive, costlier and inefficient which is widely practised at present. The intensive use of land for crop production on account of recent technological advancements in agriculture has aggravated weed problem. The use of herbicides for weed control, therefore, is gaining popularity among the farmers where it is not possible to carry out thorough tillage operations to control weeds and where labour engaged for hand weeding can be more profitably employed for carrying out other important farm operations.

Eradication of weeds by herbicides was considered more economical to mechanical means by Shivpuri and Sinha (1953). Bhardwaj and Verma (1961) reported that post-emergence application of *sodium salt* 2, 4-D @ 1 kg a e/ha proved most effective for control of weeds (except grasses) resulting in significantly higher yield than the control in wheat. Mukhopadhyay (1965) and Singh and Tomar (1966) observed that hand weeding controlled the weeds but there was some regeneration of weeds. Lokras and Tomar (1967) stated that the use of 2, 4-D @ 1·0 kg a e/ha at five-week stage was more economical in reducing weed population in wheat. Similar results are also reported by several workers including Singh (1967).

Thus, it was evident that though

* Part of the research work done by the senior author for his Master's degree.

reasonable work on the use of 2, 4-D as a weedicide has been conducted in India, practically no systematic studies seemed to have been undertaken in this respect under agro-climatic complex of Gujarat State on Mexican wheat varieties. Hence, the present investigation was undertaken to evaluate the potentiality of 2, 4-D in comparison with the traditional method of hand weeding and determine *its proper rate and time of application* for effective weed control in 'Kalyansona' wheat.

MATERIALS AND METHODS

This investigation was conducted on the mechanized commercial farm of the Gujarat Agricultural University at Junagadh Campus in *rabi* season of 1971-72 on clay soil having a pH of 8·3. The test crop was wheat 'Kalyansona'. There *were eighteen treatments* consisting of combinations of four doses of 2, 4-D (D_1-0·56, D_2-1·12, D_3-1·68 and D_4-2·24 kg a e/ha) at four times of application (T_1-full dose at 4 weeks, T_2-full dose at 6 weeks, T_3-$\frac{1}{2}$ at 4 weeks + $\frac{1}{2}$ at 6 weeks and T_4-$\frac{1}{2}$ as pre-emergence + $\frac{1}{2}$ at 4 weeks) in addition to two hand weedings at 4 weeks after sowing (HW) and an unweeded control (UC). The application of 2, 4-D at four weeks after sowing coincided with the time when wheat received two irrigations. The herbicide was dissolved in 1125 litres of water/ha *at the time of spraying*.

The design was randomized blocks with four replications having a net plot size of 7·1 m × 2·4 m. The seed of 'Kalyansona' wheat was drilled on Nov. 11, 1971 with a row-to-row space of 22·5 cm using a seed rate of 100 kg/ha. The crop was harvested on March 2, 1972. It was fertilized with 150 kg N, 75 kg P_2O_5 and 37·5 kg K_2O/ha. Protein in the composite grain samples was calculated by multiplying nitrogen percentage by a factor 6·25. Nitrogen was determined as per procedure described by Ball (1925). Phosphate and potassium were estimated according to the procedure of Muhr, Datta Sankarsubramoney, Dever, *Leley and Donahue (1963)*.

RESULTS AND DISCUSSION

Effect of different doses of 2, 4-D:

The results (Table 1) showed that the effects of different doses of 2, 4-D were identical on most of the characters studied including grain and straw yield of wheat. *Thus, the lowest dose* of 2, 4-D (0·56 kg a e/ha) had almost the same effect on the control of weeds as that observed under the highest dose of 2, 4-D (2·24 kg a e/ha). The economics also indicated use of the lowest dose for weed control under the conditions of moderate weed intensity that prevailed on the area on which the present investigation was conducted. Bhan and Maurya (1972) have advocated the rate of 0·5 kg a e/ha of 2, 4-D *for effective* control of weeds at Pantnagar. Mehta (1971) also found that the application of 2, 4-D @ 0·56 kg a e/ha was effective in controlling weeds in wheat 'NP 824' at Anand. The results of the present study coincide with the studies reported by *these* workers.

Main effects of different **treatment on weed population, yield attributes, yield and quality of 'Kalyansona' wheat.**

Treatment	Wheat plant population/ quadrate (0·81 m²) at 2 weeks	Plant height at maturity, cm	Productive shoots/ quadrate (0·81 m²) at maturity	Grain number/ spike	Grain weight spike, g	1000 kernal weight g	Yield q/ha		Wt. of air dried weeds at harvest/ net plot, g	Net profit over unweeded control Rs/ha	Wheat grain %		
							Grain	Straw			Protein	P_2O_5	K_2O
D_1	216·3	74·4	205·3	45·0	18·83	40·13	40·65	55·66	250	1272	13·19	0·35	0·39
D_2	217·7	73·4	201·4	43·4	18·49	39·33	39·89	55·84	289	1186	12·47	0·29	0·43
D_3	216·8	75·1	192·9	42·9	18·19	39·52	38·73	54·98	344	1057	12·06	0·34	0·46
D_4	216·5	75·1	199·6	43·5	18·40	39·80	39·83	57·54	278	1159	12·25	0·30	0·41
$SE_M\pm$	1·8	0·6	5·3	1·8	0·62	0·41	3·62	1·51	38				
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS	NS				
T_1	218·6	75·4	203·8	44·3	18·66	40·05	40·36	56·10	273	1231	12·41	0·28	0·40
T_2	217·4	75·4	191·8	41·8	18·23	38·80	38·54	53·18	355	1046	12·52	0·28	0·43
T_3	220·3	75·2	202·5	44·4	18·58	40·02	40·28	57·29	256	1215	12·71	0·37	0·43
T_4	221·1	72·0	201·3	44·3	18·47	39·93	39·44	57·45	277	1181	12·34	0·34	0·44
$SE_M\pm$	1·8	0·6	5·3	1·8	0·62	0·41	3·62	1·51	38				
CD at 5%	5·0	1·7	NS	NS	NS	NS	NS	NS	NS				
HW	216·5	79·3	172·5	37·1	17·29	36·68	35·42	51·14	888	620	13·03	0·21	0·40
WS	216·9	74·5	198·3	43·7	18·47	39·70	39·78	56·03	290	1168	12·47	0·32	0·42
$SE_M\pm$	3·6	1·2	11·0	3·7	1·28	0·86	2·36	3·11	79				
CD at 5%	NS	2·5	22·1	NS	NS	1·73	NS	NS	159				
UC	218·3	81·3	135·3	26·3	13·97	27·22	27·44	79·66	1375		6·39	0·18	0·30
Rest	216·8	74·8	198·3	43·3	18·42	39·52	39·52	55·71	325	1136	12·52	0·42	0·42
$SE_M\pm$	3·6	1·2	11·0	3·7	1·27	0·86	2·35	3·11	79				
CD at 5%	NS	2·5	22·1	7·3	2·56	1·73	4·73	6·25	158				

NS denotes statistically not significant, WS denotes weedicdie treatments

However, the investigations at Hissar by Sarkar and Mani (1966) as well as at Rewa (M.P.) by Khan, Malik and Dubey (1970) indicated a higher dose of 1·12 kg a e/ha of 2, 4-D to be optimum for effective weed control in wheat. This may be so because, a higher weed intensity might have required a higher dose to be effective. The work will have to be carried out for the sites having increased intensity of weeds to judge the sufficiency of such lower doses for weed control.

Effect of times of 2, 4-D applications:

Data on initial plant population of wheat indicated that it was maximum under T_3($\frac{1}{2}$ at 4 weeks + $\frac{1}{2}$ at 6 weeks) followed by T_1 (full dose at 4 weeks). There was a significant reduction under T_4 ($\frac{1}{2}$ at pre-emergence + $\frac{1}{2}$ at 4 weeks) which involved pre-emergence application. This affected the germination of wheat to a certain extent. However, the crop recovered at later growth stages as indicated by no significant differences due to different times of application in respect of productive shoots, grain number/splike as well as test weight. This was reflected in the grain and straw yield of wheat which was not significantly affected due to different times of 2, 4-D application. This is also justified from the data on total weed population which was equally affected by different treatments. The weed growth at 4 to 6 weeks after sowing might be sufficiently tender to be controlled effectively under different treatments resulting in no differential effect on the control of weeds. The treatment T_4 reduced the plant height at maturity as compared with other treatments. However, the differences though significant were not large enough to cause any significant effect on straw yield.

Mehta (1971) reported pre and post-emergence application of 2, 4-D as equally effective in controlling weeds in wheat. The results of the present investigation are in agreement with him. Mittal (1969) recommended 2, 4-D application at 30 to 35 days for Mexican wheats and 40 to 45 days for Indian wheats. Some of the workers like Mukhopadhyay (1965) found that the best time of 2, 4-D application was 4 weeks after sowing while Singh and Singh (1966) observed that the maximum mortality of weeds was attained by application 2, 4-D at six weeks after sowing wheat. Thus the time of application varied for effective control of weeds which may be due to variation in climate and intensity of weeds at different places.

No interaction was observed between doses of 2, 4-D and times of application in regard to grain yield.

Comparison of hand weeding and weedicide treatments with unweeded control:

Favourable effects of hand weeding and weedicide treatments were manifested on growth characters, various yield attributes as well as grain yield of wheat. Asana (1951) showed that unchecked weed growth reduced wheat

crop yield was significantly depressed in the presence of weeds due to greater competition for plant nutrients. This was also reflected in the protein, phosphate and potash content of wheat grains. Chokey Singh and Tondon (1966) also reported that the growth and yield attributes of wheat were significantly better in the weeded crop than the unweeded crop.

Further, the comparison of hand weeding with weedicide treatments indicated more favourable effect of the latter on productive shoots and test weight. This resulted in 12·3 per cent increased yield under weedicide treatments over hand weeding which escaped the level of significance by a narrow margin. This clearly showed the prospects for the use of 2, 4-D for weed control in wheat in comparison with the traditional practice of hand weeding. Behl and Moolani (1969) have also reported that the application of 2, 4-D @ 0·72 kg a c/ha at 30 to 45 days after sowing recorded 45 to 53 per cent additional yield in 'Kalyan 227' over weedy check.

Weed population studies:

In all, 12 weed species (both monocot and dicot types) were identified in the experimental plots which are recorded in the order of occurence below:

Monocot Weeds

Echinochloa colonum (Khadi ghas)
Cyanodon dactylon, Pers, (Dharo)
Cyperus rotundus, L. (Chidho)
Dinebra retroflexa

Dicot weeds

Digera arvensis, Forsk (Kanajro)
Commelina nudiflora (Sesamol)
Chenopodium album, L. (Chil)
Evolvulus arvensis (Narivel)
Launea nudicaulis (Boyipatri)
Portulaca oleracea (Luni)
Amaranthus paniculatus (Rajigara)
Euphorbia hirta:

After spraying, the herbicides were absorbed by the leaves or roots and translocated through plants causing serious physiological disturbances. Symptoms noticed on the weeds were twisting of leaves, bending of shoots, burning in the form of browning, blackening and finally death of the weed plants. The stems were also thickened and splitted, the foliage changed the colour and finally the plants died. The roots also were effected by herbicide, as indicated by reduction of root length and size which ultimately may not be in a position for absorption of nutrients.

Monocot weeds: The initial weed population count at 30 days after sowing under different doses of 2, 4-D varied from 24 to 38 in the net plot of 17·04 m². This was reduced to an extent of 5·31 to 7·59 at 90 days after sowing. However, the effect of different doses were found to be statistically at par at 90 days.

In the case of different times of application, the initial weed population count at 30 days after sowing varied from 14 to 34 in the net plot. This was found to be 5·15 to 7·28 at 90 days after sowing. The differences were not found to be significant.

The initial weed populations at 30 days under the unweeded control (UC) and rest of the treatments (Treated) were 83 and 31, respectively. The weed population at 80 days increased under the control having weed count of 104. There was a great decline under the rest of the treated plots at 90 days (the weed count being 10), indicating a significant effect on weeds under the treated plots.

Dicot weeds: The initial weed count at 30 days after sowing under different doses of 2, 4-D varied from 24 to 38 in the net plots. This was reduced to complete death of weeds at 90 days after sowing under all the doses of 2, 4-D.

In the case of different times of application, the initial weed population at 30 days after sowing varied from 2 to 3 weeds per net plot. This was found to be completely checked by 90 days after sowing under all the treatments.

The initial weed count at 30 days under the unweeded control was 10 which increased to 15·63 to 90 days. The rest of the treatments recorded the weed count of 3 at 30 days which was found to be only 0·42 at 90 days after sowing. The difference was highly significant.

In view of the results obtained in this investigation it can be stated that it is possible to replace hand weeding which is a conventional practice for weed control by use of 2, 4-D @ 0·56 kg a c/ha at 4 weeks after sowing 'Kalyansona' wheat, when the crop receives two irrigations.

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