https://doi.org/10.29321/MAJ.10.A03424

Madras agric. J. 61 (8): 427—432, August, 1974

Studies on the Control of White Horsenettle (*Solanum elaeagnifolium* Cav.) in Ragi (*Eleusine coracana* Gaertn.)

BY

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ABSTRACT

A field experiment was conducted to study the efficiency of different weed control measures on the control of white horsenettle in ragi crop. Manual weeding (three times) recorded the highest yield and this was followed by the post-emergence split application of 2, 4—D at 2.0 kg a. i /ha applied at 15 and 45 days after planting. Nitrofen and simazine each at 0.5 kg a. i/ha were neither effective on the weed nor selective on the crop. Among the weed control treatments, split application of 2, 4-D gave the maximum net return per rupee invested on weeding.

INTRODUCTION

Solanum elaeagnifolium Cav., a perennial weed commonly known as white horsenettle occupies about 10,000 ha in Coimbatore and Madurai districts of Tamil Nadu State. In heavily infested fields, cultivation of cereal crops have been reported to be uneconomical (Narayanan and Meenakshisundaram, 1955) due to high weeding costs. Balasubramaniam and Sakharam Rao (1964) reported that foliar spray of 2, 4 - D sodium salt at 2.2 kg per ha suppressed the weeds for a period of two months. The dose adopted was observed to be harmless to the standing crops of wheat, sorghum and pearl millet. The present investigation was taken up to study the efficiency and selectivity of a few selected herbicides including 2, 4-D on CO. 7 Ragi crop under graded doses of nitrogen.

MATERIALS AND METHODS

A field, uniformly infested with *Solanum elaeagnifolium* Cav. was selected at Chinthamanipudur, 15 km east of Coimbatore in a red loamy soil. The experiment was conducted in a split plot design during *kharif*, 1972. Weed control treatments in the main plots were: Unweeded control (T_0); hoeing and weeding thrice at 15, 30 and 45 days after planting (T_1); pre-emergence simazine at 0.5 kg a.i/ha (T_2); pre-emergence nitrofen at 0.5 kg a i/ha (T_3); post emergence 2, 4-D at 1.5 kg a.i/ha at 15 days (T_4); T_2 plus post-emergence 2,4-D at 1.0 kg a.i/ha

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TABLE 1. Effect of weed control treatments on weed and crop attributes

Treatments	Weed attributes		Crop attributes								
	Weed count/sq. m. at 90 days Sq. root transformed	Dry weight of weeds at 90 days (kg/ha) Sq.root transformed	Plant height at 90 days (cm)	Productive tillers at 90 days	Plant dry weight at 90 days (g)	Leaf area index at 50 days	No. of fingers per panicle	Mean grain weight per panicle (g)	Grain yield (kg/ha)	Mean 1000-grain weight (g)	Straw yield (Q/ha)
Main plot											
T_0	10.14	32.44	84.9	4.1	26.6	4.33	7.28	3.30	1430	2.51	62.9
T_1	7.59	15.25	92.7	7.0	86.8	5.19	7.28	5.27	4366	2.50	116.3
T_2	9.29	30.46	73.6	4.1	25.6	4.20	7.01	3.24	2656	2.52	69.4
T_3	8.63	26.99	79.2	4.3	43.0	4.27	7.19	3.46	2864	2.53	91.5
T_4	3.27	19.17	73.9	6.6	79.3	5.27	7.17	4.55	3647	2.52	106.8
T_5	8.19	21 56	73.4	4.3	45.3	4.58	7.48	3.67	2699	2.42	128.0
T_6	6.78	25.48	77.3	4.6	56.1	4.81	7.72	3.69	3010	2 44	129.3
T_7	2.07	10.67	78.1	7.6	80.1	5.41	7.19	4.68	3819	2.43	114.6
T_8	8.49	18.21	72.7	3.9	44.5	4.44	7.38	4.41	2829	2.49	87.2
T_9	9.52	18.62	75.6	4.9	49.2	4.59	7.48	4.11	3046	2.47	99.4
S. E.	0.37	0.15	1.8	0.11	2.0	0.03	0.36	0.11	110.9	0.04	1.8
C.D. at 5 %	1.10	0.44	5.2	0.3	5.9	0.08	—	0.33	335	—	5.4
'F' test	Sig.	Sig.	Sig.	Sig	Sig.	Sig.	N. S.	Sig.	Sig.	N. S.	Sig.
Sub plot											
N_1	7.29	20.55	72.5	4.26	44.4	4.26	7.33	3.99	2716	2.45	85.5
N_2	7.44	22.36	78 9	5.14	51.0	4.69	7.30	4.06	3168	2.49	100.7
N_3	7.46	24.93	82.9	6.09	56.2	5.02	7.31	4.09	3524	2 51	113.7
S. E.	0.30	0.16	0.9	0.05	0.7	0.04	0.04	0.03	92.2	0.05	2.1
C. D. at 5%	—	0.45	2.9	0.13	1.9	0.08	—	0.08	277	—	5.9
'F' test	N.S.	Sig.	Sig	Sig.	Sig.	Sig.	N. S.	Sig.	Sig.	N. S.	Sig.

at 30 days (T_5); T_3 plus post-emregence 2, 4-D at 1.0 kg a.i/ha at 30 days (T_6); post-emergence 2, 4-D at 2.0 kg a.i/ha in two split doses at 15 and 45 days (T_7); T_2 plus one hoeing and weeding at 30 days (T_8) and T_3 plus one hoeing and weeding at 30 days (T_9). The sub plot treatments were: nitrogen doses at 60 kg N/ha (N_1); 90 kg N/ha (N_2) and 120 kg N/ha (N_3). The treatments were replicated thrice and the gross and net plot sizes were 6.0×3.0 m and 4.8×2.4 m. respectively. The ragi nursery was raised on July 22, 1972 and the seedlings were transplanted on August 13, 1972 with a spacing of 15×15 cm. A basal dose of 45 kg each of phosphoric acid and potash per ha was applied to all the plots. Nitrogen was applied as per the treatments in two split applications i. e. first at the time of planting and the rest 30 days thereafter. The data on weed and crop growth and the grain yield were recorded.

RESULTS AND DISCUSSION

The experimental observations pertaining to weed and crop growth in relation to the treatments are presented in Table 1.

I. Growth characters of weeds

(i) **Weed flora:** The field was uniformly infested with the perennial white horsenettle on an average density of 100 shoots per sq. metre. Since they are aggressive by nature and spread its canopy to cover the field completely, only a few grasses like *Chloris* sp. and *Echinochloa colonum* (L) Link were present.

(ii) **Weed count:** The total number of weeds per sq. metre was the highest under unweeded control. Post-emergence application of 2, 4-D at 2.0 kg/ha and 1.5 kg/ha were outstandingly superior to all the other treatments in checking the weed population. The weed population was reduced by more than 90 per cent by 2, 4-D application even upto 90 days after the application. This confirmed the earlier observations By Balasubramaniam and Sakharam Rao (1968) who secured 80 per cent reduction in white horsenettle for two months with a dose of 2.2 kg of 2, 4-D per ha. Application of nitrofen had no effect on weed population.

(iii) **Dry weight of weeds:** The unweeded control has recorded the highest dry matter production (1058 kg/ha) and the least (117 kg/ha) under repeated application of 2, 4-D. Manual hoeing and weeding was the next best treatment in containing the dry matter accumulation in weeds. Application of 2, 4-D at 1.5 kg/ha on 15th day seems to have no sustained effect in arresting the dry weight of weeds till the maturity of the crop. Simazine and nitrofen either alone or in combination with 2, 4-D were not as effective as the 2, 4-D single or repeated applications.

The dry matter production of weeds was in linear response with the levels of nitrogen. Vengris *et al.* (1955) have also reported linear relationship in weed growth with the doses of nitrogen applied to the corn crop.

TABLE 2. Economics of different weed control treatments

Treatments	Economics of treatments			
	Value of grain and straw Rs. P.	Net income per ha (deducting cost of cultivation Rs. P.	Cost of production per kg of seed Rs. P.	Gross return per rupee invested R P
Main plots				
T_0	1442.00	342.05	0.76	1.31
T_1	3868.00	2393.25	0.34	2.62
T_2	2342.20	1192.25	0.43	2.04
T_3	2641.80	1428.35	0.42	2.18
T_4	3294.90	2147.45	0.32	2.87
T_5	2785.30	1600.55	0.44	2.28
T_6	3010.00	1762.05	0.41	2.47
T_7	3471.30	2311.35	0.30	2.99
T_8	2589.30	1314.35	0.49	2.23
T_9	2825.20	1486.75	0.44	2.28

Note

Ragi grain at Rs. 70/quintal, Ragi straw at Rs. 7/quintal
Simazine at Rs. 40/kg Nitrofen at Rs. 36/litre
2, 4-D at Rs. 25/kg Hand weeding at 50 women / ha at Rs. 2.50 / woman
Cost of spraying at Rs. 10/ha

II Growth characters of Crop:

(i) **Plant height:** The plant height was the maximum under hand weeding than the other treatments. Application of pre-emergence simazine at 0.5 kg/ha either alone or in combination with manual weeding or 2, 4-D have checked the plant height markedly. Shcheglov (1960) stated that the

application of 2, 4-D at 1.0 kg/ha during tillering of millets inhibited growth by shortening of internodes. The results of the present finding might be due to this phenomenon.

Each increment in the level of nitrogen increased the plant height.

(ii) **Productive tillers:** The number of productive tillers under repeated application of 2, 4-D was significantly superior to all the other treatments. Repeated manual weedings and single application of 2, 4-D were in the second and third order respectively. There was a linear response to nitrogen on this character.

(iii) **Dry matter production of plants:** The manual weedings and 2, 4 - D applications were on par and superior over the rest of the treatments. Simazine was not selective on the crop as seen from the least dry matter production in this treatment. Dry weight of crop was successively increased significantly with each increment of nitrogen. Fillipenko and Pavlova (1964) obtained higher dry matter in wheat by the application of 2, 4-D at 2.0 kg/ha. The present results in ragi, a heavy tillering crop like wheat, corraborates the earlier report.

(iv) **Leaf area index:** The treatment 2, 4 - D at 2.0 kg/ha was significantly superior to all the other treatments in increasing the leaf area of this crop. Next in order were application of 2, 4-D at 1.5 kg/ha and the repeated manual weeding which were on par. Simazine and nitrofen have caused a great set back in the leaf area index and they were on par with the unweeded control. The leaf area index showed a linear trend with the nitrogen levels.

(v) **Finger number per panicle:** Neither the weed control treatments nor the nitrogen rates had any influence on this character.

(vi) **Grain weight per panicle;** The repeated hand weeding treatment was outstandingly superior in increasing the grain weight per panicle. Repeated and single spray of 2, 4-D were in the next order and on par with simazine plus 2, 4-D treatment. Rates of nitrogen had a progressive influence on grain weight but any two successive doses were on par.

(vii) **Grain yield:** The grain yield under manual weeding was superior to the rest of the treatments. Repeated and single applications of 2, 4 - D were on par and registered the second rank in grain yield. The superior yields in these three treatments were mainly due to higher productive tiller production, rank growth and mean grain weight per panicle. Application of 2, 4-D had been reported earlier to influence the yield attributes and yield of ragi (Krishnamurthy, 1969 and Subbiah and Sankaran, 1973).

There were significant yield increases for each increment of nitrogen from 60 to 120 kg/ha. The highest yield under maximum dose was mainly due to the increases in productive tillers and panicle weight.

III. Economics of treatments

Among the herbicide treatments the lowest cost was under the post-emergence treatment of 2, 4-D at 1.5 kg/ha (Table 2.). The maximum yield was obtained in the manual weeding treatment and the gross income was also more in this treatment. As regards the net income, the manual weeding treatment was superior but this was closely followed by the treatment 2. 4-D at 2.0 kg/ha as the difference in net income was less by Rs. 81.90 only.

The cost of production per kg of seed and the gross return per rupee invested were beneficial under 2, 4-D treatments.

ACKNOWLEDGEMENT

The first author acknowledges with gratitude the Indian Council of Agricultural Research for awarding the Junior Research Fellowship in Agronomy during the course of the study. He also thanks the Tamil Nadu Agricultural University for kindly according permission to publish the M. Sc. (Ag.) dissertation.

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