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Short Communication

Cost reduction in cabbage cultivation by weed control using oryzalin herbicide and hoeing technology

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One pre-emergent application of oryzalin 40% SC herbicide and one hoeing was found to control maximum pests of cabbage crop. By following proper date of sowing of cabbage crop and controlling the weeds, no pest including insect and diseases was observed to attack the crop. During the period of controlling weeds of cabbage crop neither insect pest nor any fungal attack was observed during the period of this study. The insects and diseases were thus below economic threshold value.

Keywords: Cabbage cultivation, oryzalin, herbicide, economics analysis.

INTRODUCTION

Cabbage *(Brassica oleracea* L. var *capitata) is* one of the important winter vegetables grown in India. Cabbage yield and head quality are reduced by disease infection and by infestations of insects and weeds (Geeson and Browne, 1979). Although various studies have reported methods to effectively control insects and diseases in cabbage (Bedlan, 1998; Panda et al., 1999; Panda et al., 1999), weed control in this crop has not been extensively studied in India. Weeds cause direct loss in cabbage by competing for nutrients while also acting as host for disease causing pathogens (Arora and Mittal, 1998). Major weed species of cabbage in the Nadia district of West Bengal include *Coronopus didymus* and *Melilotus indica*, while minor weed species include *Partheniun hysterophorus* and *Rumex dentatus*. The major pests of cabbage are Diamond Back Moth (DBM) and *Alternaria solani (*Hua et al., 1998), It was hypothesized that oryzalin applied prior to cabbage transplanting and coupled with hand hoeing would adequately control weeds and maximize yield and quality in that crop.

MATERIALS AND METHODS

Cabbage crop (var. Rareball) was raised in the fields of Mandauri at B. C. K. V Mohanpur, Nadia, West Bengal, India using a randomed complete block design (RCBD). The plot size was 5 x 2 m^2 with 40 cm distance between plants and rows. The date of transplanting was 23rd October, 2006 and date of harvest was 16th January, 2007. During the study, the average maximum and minimum temperatures were 27.6°C and 12.2°C, respectively. The mean daily temperature was 17.9°C, relative humidity averaged 59.5%, day length was 6.6 h, and rainfall totaled 16 mm during the period. Irrigation was done four times at 15 days interval including first one given on date of transplanting.

The treatments were i) T_1 - one hoeing, ii) T_2 oryzalin @ 1.5 kg ai ha^{-1}, iii) T_3 - oryzalin @ 3 kg ai ha^{-1}, iv) T_4 - oryzalin @ 1.5 kg ai ha^{-1} + one hoeing, v) T_5 - oryzalin @ 3 kg ai ha^{-1} + one hoeing and vi) T_6- nontreated control. Oryzalin was applied 10 days before transplant of cabbage seedlings using a Knapsack sprayer with a delivery rate of 600 L/ha. The plots were cultivated prior to transplanting. No weeds were present after land preparation for transplanting. The treatments were banded over the row. Cabbage rows were hoed by hand twenty days after transplanting. No other pest, including DBM, *Helicoverpa, Alternaria* or *Xanthomonas* was observed above their economic threshold level, so only weed population count was undertaken. The number of DBM insects were counted on 4 plants from each sub-plot. The number of weeds within a randomly-placed 1 m^2 quadrat was counted in all plots prior to cabbage harvest (16th January, 2007), and fresh weight of weeds by species was measured. Dry weight obtained by oven drying of the samples at 75°C for 24 h.

RESULTS AND DISCUSSION

The population of major and minor weeds is presented in

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Table 1. Weed biomass and density under different oryzalin and hoeing treatments in cabbage.

Weeds	Fresh biomass (gm^{-2})					Density (numbers m^{-2})					
	T_1	T_2	T_3	T_4	T_5	T_1	T_2	T_3	T_4	T_5	T_6
Coronopus didymus	121.4 (18.4)	31.3 (7.2)	2.1 (0.19)	28.5 (6.8)	136.4 (21.0)	49.5	11.5	0.5	9.5	0.0	56.5
Melilotus indica	6.9 (0.8)	4.6 (1.1)	0.0	4.0 (0.92)	5.1 (0.9)	39	2.5	0.0	2.2	0.0	41.0
Phalaris minor	49.6 (7.1)	45.1 (10.4)	7.8 (1.2)	40.7 (0.98)	52.6 (8.0)	6.8	3.5	2.0	1.8	0.9	3.5
Canabis sativa	7.6 (1.2)	0.2 (0.04)	0.0	0.0	10.4 (1.5)	3.1	0.06	0.0	0.0	0.0	4.2
Rumex dentatus	20.4 (2.9)	3.1 (0.5)	1.6 (0.1)	2.8 (0.3)	22.6 (3.4)	7.2	0.9	0.3	0.5	0.0	8.2
Anagallis arvensis	0.96 (0.1)	0.0	0.0	0.0	1.3 (0.2)	0.0	0.0	0.0	0.0	0.0	2.5
Total	206.86	84.3	11.5	76.0	228.4	106. 5	18.4 6	2.8	14.0	0.9	120. 9

Figures in parenthesis indicate dry weight; Treatments : T_1 - one hoeing, T_2- 1.5 Kg ha^{-1} oryzalin, T_3-3 Kg ha^{-1} oryzalin, T_4 – 1.5 Kg ha^{-1} oryzalin + hoeing, T_5 - 3 Kg ha^{-1} oryzalin + hoeing, T_6 - Control (No treatment).

Table 2. Economics of cabbage cultivation following hoeing and oryzalin treatments.

Treatments	Yield (q ha-1)	Production cost (Rs)	Gross income (Rs)	Net Returns (Rs)
T_1	439.3	13,740	32,947	19,207
T_2	433.7	13,430	32,527	19,097
T_3	387.0	14,410	29,025	14,615
T_4	488.3	14,630	36,622	21,992
T_5	407.3	15,120	30,547	15,427
T_6	330.0	12,540	24,750	12,210

$CD_{5\%}$ = 3.624; $CD_{1\%}$ = 5.155; Treatments : T_1 - one hoeing, T_2 – 1.5 Kg ha^{-1} Oryzalin, T_3 - 3 Kg ha^{-1} Oryzalin, T_4 – 1.5 Kg ha^{-1} Oryzalin + hoeing, T_5- 3 Kg ha^{-1} Oryzalin + hoeing, T_6 - Control (No treatment); 1 US$= 42.00 Indian Rupees (Rs.) approx (in 2006).

Table 1. *C. didymus* was the major weed species with in the nontreated control (T_6), averaging 56.5 weeds m^{-2} with a fresh weight of 136.4 g m^{-2}, P*halaris* minor recorded the second highest biomass (52.6 g m^{-2}), while *M. indica,* was the second most numerous at 41 weeds m^{-2}.

Hoeing alone reduced the weed count of *C. didymus* from 136.4 in T_6 to 121.4 in T_1. Application of oryzalin at the normal dose (1.5 kg ha^{-1}, T_2) reduced the population of *C. didymus* to 11.5 weeds m^{-2} and 3 kg ha^{-1} (T_3) further reduced it to 0.5 weeds m^{-2}. While *M. indica* was completely controlled, *P. minor* density was reduced to 2.0 in treatment T_2. Similar results were observed with biomass of weeds in treated plots. One application of oryzalin at 1.5 kg ha^{-1} along with one hoeing (T_4) further reduced the *C. didymus* population to 28.5 g. Oryzalin at 3 kg ha^{-1} along with one hoeing (T_5) eliminated *C. didymus*, but since that rate resulted in phytotoxicity to the cabbage and led to yield reduction, treatment T_4, involving one application of oryzalin at the recommended rate of application followed by hoeing was found to optimum. The fresh as well as dry weight of weeds was reduced, as the number of weeds was reduced.

The yield of cabbage from the plots treated with oryzalin was higher as compared to that obtained from control (untreated) plots (Table 2). The yield was still higher in the treated plots, where besides oryzalin treatment; one additional hoeing was carried out.

The statistical analysis of yield data in Table 2 shows that Critical Difference (CD) calculated at 5% level is 3.624 quintal ha^{-1} and at 1% level is 5.155 q ha^{-1}. The CD at both 1 and 5% levels is quite lower than the difference of T_6, T_1; T_2, T_4 ; and T_4 , T_3 which indicates that treatments T_6, T_1, T_2, T_4 ; and T_4 , T_3, are significantly different from each other but not T_3, and T_5.

The data in Table 1 clearly indicates that oryzalin is highly effective for weed control in cabbage. Crop yield data, however (Table 2) show that application of 3 kg ha^{-1} lowered yield compared to the 1.5 kg ha^{-1} and therefore is not recommended for cabbage production.

The highest yield of cabbage was realized from the plots treated with oryzalin at 1.5 kg ha^{-1} followed by one hoeing (T_4), compared to all other treatments. The poorest yield was obtained in the non-treated, non-hoed

plots (T_6), due to the high density and biomass of weeds. But cabbage yield was also significantly reduced when oryzalin was applied at 3.0 kg ha^{-1} (T_3 and T_5) despite minimal weed density and biomass, due to herbicide phytotoxicity to cabbage.

Considering the selling price (in 2006) of cabbage as Rs 75 q^{-1} in Nadia, W.B, the additional earnings can be calculated as Rs 21,992 ha^{-1}.

Oryzalin along with hoeing controlled weeds (Table 1). Date of sowing helped in avoiding on slaught of insect and disease attack. As the inoculums of disease and insect harbor in weeds, it was envisaged that control of weeds and sanitation in field due to herbicide application and one hoeing led to improved yield as shown in Table 2. It can be therefore concluded that if date of sowing of cabbage crop is delayed for 10 - 15 days, there is a definite pest attack, especially DBM on cabbage crop even after following weed control practices (Arora and Mittal, 1998).

Oryzalin at 1.5 kg ha^{-1} followed by one hoeing of cabbage crop gave excellent yield results among other tested treatments. Oryzalin has been found to be a persistent herbicide (Blanco et al., 1988; Speich, 2003). Moreover by controlling weeds of cabbage crop neither insect pest nor any fungal attack was observed during the period of this study. The insects and diseases were thus below economic threshold value. The study confirms the report by Saimbhi et al., (1992) in which oryzalin used for weed control enhanced disease control in cabbage.

REFERENCES

Arora S, Gopal M (2006). Bioeff icacy of Iprodione against two desapers, its compatibility with T. *harzianum* and residues on cabbage crop. J. Environ. Sci. health IS 41 (6): 949-963.

Arora S, Gopal M *(*2005). Potential of fipronil and *Bacillus thuringiensis* to control *Plutella xylostella* on cabbage crop. Int. Pest Control 47 (5): 251-256.

Arora S, Mittal A *(1998)* Integrated weed management. Indian farming. 48: 20.

Bedlan G (1998) Application management to control post harvest Botrytis infections on Chinese cabbage. Gesunde Pflanzen 50: 162-164.

Blanco HG, Oliveira DA, Matallo MB (1988). Persistence and residues of oryzalin in soils under soybean crop.*Pesquisa Agropecuaria Brasileira*. 23: (10): 1107-1113

Geeson JD, Browne KM (1979). Effect of post harvest fungicide drenches on stored winter white cabbage. Plant Pathol. 28: 161-168.

Panda SK, Behera UK, Nayak SK *(*1999). Bio-efficacy of fipronil *5% SC* against diamond back moth, *Plutella xylostella* (Linn.) (Yponomeutidae, Lepidoptera) infesting cabbage. Insect Environ. 5: 104-105.

Saim bhi MS, Sandhu KS, Singh D, Kooner KS, Dhiman JS, Dhillon INIPS, Singh DU *(1992).* Use of herbicide for weed and disease control in cabbages. Advances in Hort. Sci. 6: 125-128.

Shi Zu Hua, Shu Sheng L, Shi ZH, Liu SS *(1998)* Toxicity of insecticides commonly used in vegetable fields to the diamondback moth, *Plutella xylostella* and its parasite, *Cotesia plutellae. Chinese* J. Biol. Control 14: 53-57.

Speich P (2003). Chemical *weed* control: modifications of practices and their impact on transfer of chemicals to water.*Progres Agricole et Viticole*. 120: (5): 113-118.