Indian J. Weed Sci. **36** (1 & 2) : 104-107 (2004)

Weed Management in Opium Poppy (*Papaver somniferum* L.)

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ABSTRACT

A field experiment was conducted at K. N. K. College of Horticulture, J. N. K. V. V., Mandsaur (M. P.) under AICRP on Medicinal and Aromatic Plants during winter (**rabi**) seasons of 1995-96 and 1996-97 to find out the suitable weed management practices in opium poppy. Field studies revealed that pre-emergence (PE) application of isoproturon coupled with hand weeding (HW) at 30 days after sowing (DAS) proved more effective in reducing weed population and weed biomass and in increasing yield and attributes of opium poppy than isoproturon applied as pre-emergence alone. Isoproturon at 375 g ha^{-1} PE+HW at 30 DAS and isoproturon at 500 g ha^{-1} PE+HW at 30 DAS were as effective as weed-free check in reducing density and biomass of weeds and in increasing yield attributing characters viz., capsules $plant^{-1}$, capsule diameter and capsule length and latex, seed and husk yields and net profit. Maximum weed mortality (WM, 92.1%) with latex yield (74.6 kg ha^{-1}), seed yield (711.3 kg ha^{-1}), husk yield (744.3 kg ha^{-1}) and net profit (Rs. 42990 ha^{-1}) were recorded under weed-free check and it was closely followed by isoproturon at 375 g ha^{-1} PE+HW at 30 DAS and isoproturon at 500 g ha^{-1} PE+HW at 30 DAS, where 83.6 and 90.1% WM, 70.1 and 62.8 kg ha^{-1} latex yield, 664.3 and 605.3 kg ha^{-1} seed yield, 677.8 and 593.9 kg ha^{-1} husk yield and Rs. 42812 and 36154 ha^{-1} net profit were recorded, respectively. Morphine content of opium remained unaffected due to use of isoproturon in opium poppy. Uncontrolled weed growth caused 57.4% mean loss in latex (50.8%), seed (61.5%) and husk (59.8%) yields. Higher dose of isoproturon at 500 g ha^{-1} PE caused 22.5% phytotoxicity on opium crop.

INTRODUCTION

Opium poppy (*Papaver somniferum* L.) is an important medicinal plant of Malwa Plateau of Madhya Pradesh which is grown as a winter crop for latex and seed. The latex collected from fully grown capsules is medicinally important and the seeds are used for culinary purpose. The latex is rich in about 40 alkaloids of which morphine, narcotine, codine, thebaine and papaverine are of commercial importance. The alkaloids are used in preparation of modern medicines prescribed as analgesic, sedative, antipasmodic, anaesthetic and hypnotic. Poppy seeds contain about 24% protein and 52% oil having blood cholesterol lowering property which makes it desirable to prevent coronary heart trouble. India is the largest producer and supplier of opium and it holds a monopoly in the world trade of opium. Frequent irrigation for proper emergence coupled with very slow initial seedling growth of opium poppy offers congenial conditions for weed growth on vertisols of this region and suppresses seedlings of the crop. In addition time of weeding in garlic (*Allium sativum* L.), a most important spice crop of this region, coincides with weed operations of this crop which further accentuate labour problems. Hence, use of pre-emergence herbicides in combination with hand weeding can be effective in controlling weeds during critical period of first 30-40 days after sowing. Weed-free plots followed by pre-emergence spray of isoproturon at 125 g ha^{-1} recorded highest latex, seed and capsule husk yields of opium poppy (Sharma and Nepalia, 1997).

Pre-emergence application of chlortoluron has also been reported in opium poppy (Gaur *et al.*, 1986). No much information is available on weed management practices in opium poppy. Therefore, the present study was undertaken to find out the effect of isoproturon alone and in combination with weeding on weeds and crop yield of opium.

MATERIALS AND METHODS

A field experiment was conducted at Research Farm of K. N. K. College of Horticulture, J. N. Krishi Vishwa Vidyalaya, Mandsaur (M. P.) during winter **(rabi)** seasons of 1995-96 and 1996-97 to find out the suitable effective dose of isoproturon alone or in combination with weeding in opium poppy. The soil was clay loam having pH 8.13, organic carbon 0.49%, available N 278.8 kg ha^{-1}, available P 10.69 kg ha^{-1} and available K 510.24 kg ha^{-1}. Winter rainfall received during the crop growth period was 48 mm in 1996. The weather remained clear during lancing operation in the first crop season but it remained cloudy in the second crop season.

Ten treatments were tried in a randomized block design with three replications. Four doses of isoproturon at 125, 250, 375 and 500 g ha^{-1} as pre-emergence (PE) alone and each supplemented with one weeding at 30 days after sowing (DAS) were compared with weed-free and weedy checks. Crop variety JA-16 was seeded by using 10 kg ha^{-1} seed rate in rows 30 cm apart during first week of November in both the years of experimentation. The crop was fertilized with 100 kg N, 50 kg P and 25 kg K ha^{-1}. Half N, full P and K were applied as basal at sowing. Remaining N was applied as top dressing at 30 at 60 DAS. In all eight irrigations were applied during crop growth period (November to March). Proper plant protection measures were taken for controlling downy mildew and powdery mildew diseases. Lancing and collecting operations of latex were started in second week of March and completed in last week of March in both the years. Weedy mortality (WM) was calculated as per formula suggested by Mani *et al.* (1973).

RESULTS AND DISCUSSION

Effect on Weeds

The major weeds of experimental field were : *Chenopodium album, Rumex acetosella, Convolvulus arvensis, Dinebra retroflexa* and *Dinebra arabica* and accounted for about 80% of the total density. Other weeds such as *Anagallis arvensis, Sonchus arvensis, Melilotus indica, Cichorium intybus, Digera arvensis, Solanum nigrum* and *Cyperus rotundus* were low in density and accounted for about 20% of the total weed density.

All the weed control treatments caused significant reduction in density and dry biomass of weeds compared with weedy check (Table 1). Pre-emergence application of isoproturon integrated with one weeding at 30 DAS proved effective in reducing the desnity and dry biomass of weeds as compared to isoproturon applied alone. Maximum reduction in weed density (92.1% WM) and weed dry biomass (98% WCE) was obtained from weed-free check which was at par with isoproturon at 500 g ha^{-1}+weeding and isoproturon at 375 g ha^{-1} PE+weeding. Isoproturon at 250 g ha^{-1}+weeding proved superior to isoproturon at 500 and 375 g ha^{-1} alone in reducing the density and dry biomass of weeds. Isoproturon at 125 to 500 g ha^{-1} alone significantly reduced density and dry biomass of weeds compared to weedy check but its all doses (125-500 g ha^{-1}) alone proved inferior to those integrated with weeding at 30 DAS.

Effect on Crop

Weed-free treatment followed by isoproturon at 375 g ha^{-1}+weeding and isoproturon at 375 g ha^{-1} alone produced significantly highest capsules

Table 1. Effect of treatments on weeds and yield attributes of opium (Mean values for two seasons)

Treatment	Dose (g ha^{-1})	Weed density (No. m^{-2})	Weed mortality (%)	Weed dry biomass (g m^{-2})	Crop population (No. m^{-2})	Crop injury (%)	Capsules (No. m^{-2})	Capsule length (cm)	Capsule diameter (cm)
Isoproturon	125	51	34.6	133.8	39	7.5	1.7	4.7	9.5
Isoproturon	250	39	48.8	119.3	39	8.6	1.8	4.7	9.9
Isoproturon	375	32	59.3	97.4	38	10.8	1.8	4.8	10.1
Isoproturon	500	24	68.0	91.1	33	22.7	1.6	4.4	9.0
Isoproturon fb weeding	125	28	62.8	80.2	41	3.3	1.8	4.8	9.5
Isoproturon fb weeding 30 DAS	250	23	69.8	68.0	40	6.7	1.8	4.9	10.0
Isoproturon fb weeding 30 DAS	375	20	74.0	56.0	39	8.8	1.8	5.1	10.2
Isoproturon fb weeding 30 DAS	500	14	80.7	36.9	33	22.2	1.6	4.6	9.7
Weed-free		6	92.1	4.8	42	0.3	1.9	5.2	10.5
Weedy		84	-	202.5	42	0.0	1.5	4.3	8.5
LSD (P=0.05)		16	-	63.0	NS	10.1	0.3	0.5	1.0

fb–followed by, NS–Not Significant.

$plant^{-1}$, capsule diameter and capsule length as compared with weedy check and rest of the treatments (Table 1). Isoproturon at 125, 250 and 500 g ha^{-1} alone and their integration with weeding at 30 DAS improved all yield attributes significantly over weedy check. Plant population remained unaffected due to use of isoproturon. Isoproturon 500 g ha^{-1} alone and its integration with weeding at 30 DAS caused significantly higher crop injury (22.7 and 22.2%) than all other weed control treatments.

All weed control treatments gave significantly higher latex, seed and husk yields than weedy check, except isoproturon at 125 g ha^{-1} alone (Table 2). Maximum latex, seed and husk yields were recorded from weed-free check and it was proved significantly superior to weedy check, isoproturon

Table 2. Effect of treatments on crop yield, quality and economics (Mean of two seasons)

Treatment	Dose (g ha^{-1})	Seed yield (kg ha^{-1})	Husk yield (kg ha^{-1})	Latex yield (kg ha^{-1})	Morphine content (%)	Additional return over control (Rs. ha^{-1})	Additional cost over control (Rs. ha^{-1})	Net profit (Rs. ha^{-1})	B : C ratio
Isoproturon	125	337.2	373.9	35.0	12.3	9162	176	8936	50.3
Isoproturon	250	438.9	479.8	47.1	13.0	20678	231	20447	87.6
Isoproturon	375	501.2	530.7	51.5	14.1	26372	286	26085	90.7
Isoproturon	500	487.2	514.8	51.3	11.6	25573	341	25232	73.6
Isoproturon fb weeding 30 DAS	125	498.8	538.9	55.4	11.8	28132	1798	26334	14.2
Isoproturon fb weeding 30 DAS	250	586.7	635.1	61.6	10.9	36477	1853	34624	18.2
Isoproturon fb weeding 30 DAS	375	664.4	677.8	70.1	14.5	44720	1908	42812	22.0
Isoproturon fb weeding 30 DAS	500	605.3	593.9	62.8	12.2	38116	1963	36153	18.0
Weed-free		711.3	744.3	74.6	13.7	49478	6488	42990	6.5
Weedy		218.8	260.0	34.0	10.6	-	-	-	-
LSD (P=0.05)		172.8	174.1	13.3	NS	-	-	-	-

fb–followed by, NS–Not Significant.

Prevailing market price (Rs./kg) : Seed 70 and 68, latex 300 and 396, husk 0.50 and 0.50, isoproturon 330, herbicide application 3 and 3 labourers/ha, weeding 40 and 40 labourers/ha, labour charges 38.80 and 42.30/day/labour for 1995-96 and 1996-97, respectively.

at 125, 250, 375 and 500 g ha^{-1} alone and isoproturon at 125 g ha^{-1} PE+weeding but it was closely followed by isoproturon at 375 g ha^{-1} PE+weeding and isoproturon at 500 g ha^{-1}+weeding. Significant increase in yields was probably due to higher weed mortality under these treatments. Minimum mean loss in latex, seed and husk yields (8.1%) was recorded under isoproturon at 375 g ha^{-1}+ weeding followed by isoproturon 250 g ha^{-1}+weeding (17.8%) and isoproturon at 500 g ha^{-1}+weeding (18%). Unchecked weeds caused 57.4% mean loss in yields of opium poppy under weedy check treatment. Morphine content of opium poppy remained unaffected due to pre-emergence application of isoproturon.

Economics

Maximum net profit of Rs. 42990 ha^{-1} was realized with weed-free check, closely followed by isoproturon at 375 g ha^{-1}+weeding (Rs. 42812 ha^{-1}). Next best remunerative treatments were isoproturon at 500 g ha^{-1}+weeding (Rs. 36153 ha^{-1}) and isoproturon at 250 g ha^{-1}+weeding (Rs. 34624 ha^{-1}). All doses of isoproturon integrated with hand weeding fetched lower B : C ratio (14.1-22) than all doses of isoproturon applied alone (50.3-90.7), where highest B : C ratio of 90.7 was recorded under isoproturon 375 g ha^{-1} alone followed by isoproturon at 250 g ha^{-1} alone (87.6). On the basis of present study, it can be concluded that opium poppy crop can be grown successfully with isoproturon at 375 g ha^{-1} PE followed by one hand weeding at 30 days after sowing under Malwa Plateau region of Madhya Pradesh.

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