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Smothering effect of different crops on weed *Malva neglecta* Wallr.

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Abstract: Field study was conducted at experimental farm of Punjab Agricultural University ,Ludhiana (India) during rabi seasons of 2004-05 and 2005-06. The experiment was laid out in randomized block design with fourteen treatments having combination of seven different crops viz. bread wheat, durum wheat, six - rowed barley, two-rowed barley, raya, *gobhi sarson,* linseed and two weed control treatments i.e. hand weeded and unweeded. The study was planned with an objective to find out the most suitable *Rabi* crop that can suppress the weeds to maximum extent with minimum reduction in yield as there was no herbicide available which can control the weeds in an effective manner. Minimum weed dry matter accumulation was observed in *raya* (0.97qha^{-1} in the weeded plot) whereas maximum dry matter accumulation was observed in bread wheat (8.3qha^{-1}), followed by durum wheat (6.1qha^{-1}), linseed(5.0qha^{-1}), barley (6-row) (4.9qha^{-1}), barley (2-row) (2.6qha^{-1}) and *gobhi sarson* (2.4qha^{-1}). Raya (*Brassica juncea*) showed maximum suppressing potential as minimum per cent reduction in crop yield of unweeded over weeded (7.4%) and minimum per cent increase in weed dry matter of unweeded over weeded(44%) was observed in this crop. Gobhi sarson (*Brassica napus*) was the next best smothering crop followed by barley (2-row), barley (6-row), linseed, durum wheat and bread wheat, respectively in suppressing the *M. neglecta*. Two hand weedings treatment proved better in controlling the weeds as compared to unweeded treatment.

Keywords: Hand weedings, *Malva neglecta*, Rabi crops, Smothering effect, Weed control

INTRODUCTION

Among the various factors responsible for low yield of crops, weed infestation is the major one. It is a major bottleneck to higher wheat productivity, and accounts for more than 48% loss of potential wheat yield (Khan and Haq, 2002). Weeds are omnipresent pests that compete with crops for water, nutrients, space, and light; host pests and diseases; and release allelochemicals into the rhizosphere (Khaliq *et al*., 2013 a, 2014 a,b). The magnitude of weed related losses, however, depends on the type and density of a particular weed species, its time of emergence, and the duration of interference (Estorninos *et al*., 2005; Hussain *et al*., 2015).Yield losses are most severe when sources are limited and weeds and crops emerge simultaneously (Zimdahl, 2007; Hussain *et al*.,2015).Weeds cause maximum damage during the early stages of crop growth. Among the dicot weeds affecting rabi crops, *Malva neglecta* Wallr. is a new emerging problematic weed, commonly known as common mallow/ button weed/cheese plant/cheese weed and belongs to mallow family (Malvaceae). It is a broadleaf winter annual weed. It propagates through seed. It was introduced from Europe and found throughout in the United States in waste areas, gardens and cultivated land. During 1997 and 1998, it was intercepted and identified in wheat grain consignments imported through 10 major ports of India (Singh, 2001).

Steffey (1980) reported mallow as one of the worst weeds of gardens in the United States and recently, it has become troublesome in field crops causing yield losses of upto 30 per cent in wheat and upto 90 per cent in flax (Makowski and Mortensen 1989). From the Alberta Agriculture weed alert reporting system, *M. neglecta* was identified as the 49th most abundant weed in major field crops with a maximum density of 6.8 plants m^{-2} (Dexter *et al* 1981). Several selective herbicides like metribuzin, linuron, cyanazine, clopyralid ,picloram, chlorsulfuron and metsulfuron methyl have been tried, but none have provided a consistently high degree of control at the rates tested (Donaghy and Sturko 1983a, b; Maurice and Cole 1986). Therefore, the present investigation was carried out to find out the most suitable rabi crop that can suppress the weed *Malva neglecta* to maximum extent without having much reduction in crop yield.

MATERIALS AND METHODS

The field experiment was conducted at Students' Farm, Department of Agronomy, Punjab Agricultural University, Ludhiana during the *rabi* seasons of 2004-05(I year) and 2005-06(II year) in a randomized block design with three replications The soil of the experi-

Table 1. Periodic population of *M. neglecta* as influenced by various *rabi* crops and weed control treatments.

		Population of *M. neglecta* (m^{-2})											
		15 DAS			30 DAS			45 DAS			60 DAS		
Treatment		**I year**	**II year**	**Mean**	**I year**	**II year**	**Mean**	**I year**	**II year**	**Mean**	**I year**	**II year**	**Mean**
Bread wheat	W	5.92	6.29		8.01	8.38		6.0	6.50		5.83	6.35	
		(34.0)	(38.6)	(36.3)	(63.3)	(69.3)	(66.3)	(35.0)	(41.3)	(38.1)	(33.0)	(39.3)	(36.1)
	UW	5.86	6.19		8.14	8.43		9.81	10.34		10.39	10.82	
		(33.3)	(37.3)	(35.3)	(65.3)	(70.0)	(67.6)	(95.3)	(106.0)	(100.5)	(107.0)	(116.0)	(111.5)
Durum wheat	W	5.57	5.92		7.89	8.26		5.68	6.0		5.53	5.86	
		(30.0)	(34.0)	(32.0)	(61.3)	(67.3)	(64.3)	(31.3)	(35.0)	(33.1)	(29.6)	(33.3)	(31.4)
	UW	5.38	5.80		7.74	7.94		9.33	9.85		9.85	(10.35	
		(28.0)	(32.6)	(30.3)	(59.0)	(62.0)	(60.5)	(86.0)	(96.0)	(91.0)	(96.0)	(106.3)	(101.1)
Barley (6-row)	W	5.25	5.57		7.42	7.74		5.35	5.77		5.09	5.62	
		(26.6)	(30.0)	(28.3)	(54.0)	(59.0)	(56.5)	(27.6)	(32.3)	(29.9)	(25.0)	(30.6)	(27.8)
	UW	5.32	5.62		7.59	8.02		8.98	9.35		9.43	9.75	
		(27.3)	(30.6)	(28.9)	(56.6)	(63.3)	(59.9)	(79.6)	(86.5)	(83.0)	(88.0)	(94.0)	(91.0)
Barley (2-row)	W	5.42	5.80		7.63	8.02		5.03	5.57		4.79	5.38	
		(28.3)	(32.6)	(30.4)	(57.3)	(63.3)	(60.3)	(24.3)	(30.0)	(27.1)	(22.0)	(28.0)	(25.0)
	UW	5.80	6.13		7.85	8.23		8.68	9.03		9.07	9.43	
		(32.6)	(36.6)	(34.6)	(60.6)	(66.7)	(63.6)	(74.3)	(80.6)	(77.4)	(81.3)	(88.0)	(84.6)
Raya	W	5.50	5.74		7.48	7.83		4.58	5.13		4.16	4.72	
		(29.3)	(32.0)	(30.6)	(55.0)	(60.3)	(57.6)	(20.0)	(25.3)	(22.6)	(16.3)	(21.3)	(18.8)
	UW	5.68	5.94		7.65	7.94		8.25	8.60		8.56	8.90	
		(31.3)	(34.3)	(32.8)	(57.6)	(62.0)	(59.8)	(67.0)	(73.0)	(70.0)	(72.3)	(78.3)	(75.3)
Gobhi Sarson	W	5.66	5.97		7.85	8.06		4.86	5.38		4.61	5.13	
		(31.0)	(34.6)	(32.8)	(60.6)	(64.0)	(62.3)	(22.6)	(28.0)	(25.3)	(20.3)	(25.3)	(22.8)
	UW	5.72	6.02		7.61	7.97		8.38	8.72		8.64	9.02	
		(31.8)	(35.3)	(33.5)	(57.0)	(62.6)	(59.8)	(69.3)	(75.0)	(72.1)	(73.6)	(80.3)	(76.9)
Linseed	W	5.38	5.97		7.42	7.70		5.48	5.83		5.35	5.79	
		(28.0)	(34.6)	(31.3)	(54.0)	(58.3)	(56.1)	(29.0)	(33.0)	(31.0)	(27.6)	(32.6)	(30.1)
	UW	5.49	5.68		7.83	8.14		9.11	9.48		9.64	10.0	
		(29.2)	(31.3)	(30.2)	(60.3)	(65.3)	(62.8)	(82.0)	(89.0)	(85.5)	(92.0)	(99.0)	(95.5)
CD (P=0.05)		NS	NS		NS	NS		2.51	1.55		1.21	1.19	

Values in parentheses are original values; data is transformed to $\sqrt{x+1}$ transformation (sq. root)

Table 2. Periodic plant height and dry matter (q ha^{-1}) of *M. neglecta* as influenced by various *rabi* crops and weed control treatments.

Treatment		Plant height(cm) 90 DAS Year I	90 DAS Year II	90 DAS Mean	At harvest Year I	At harvest Year II	At harvest Mean
Bread wheat	W	27.6	25.8	26.7	92.0	85.4	88.7
	UW	30.0	28.5	29.2	105.0	97.5	101.2
Durum wheat	W	25.5	23.7	24.6	80.5	78.0	79.2
	UW	27.6	25.1	26.3	87.0	83.0	85.0
Barley (6-row)	W	22.0	19.9	20.9	66.5	63.9	65.2
	UW	24.0	21.6	22.8	71.0	68.5	69.7
Barley (2-row)	W	19.0	18.8	18.9	62.6	58.5	60.5
	UW	21.2	19.5	20.3	66.5	61.3	63.9
Raya	W	15.5	13.5	14.5	55.1	54.0	54.5
	UW	17.0	14.9	15.9	59.0	57.5	58.2
Gobhi Sarson	W	17.0	16.0	16.5	58.7	56.0	57.3
	UW	19.5	18.5	19.0	62.0	59.5	60.7
Linseed	W	23.7	22.2	22.9	73.8	70.8	72.2
	UW	25.0	23.5	24.2	79.2	75.6	77.4
CD (P=0.05)		1.4	1.2		4.1	3.8	

Treatment		Dry matter (q ha^{-1}) 90 DAS Year I	90 DAS Year II	90 DAS Mean	At harvest Year I	At harvest Year II	At harvest Mean
Bread wheat	W	1.83 (2.4)	1.89 (2.6)	(2.5)	2.97 (7.8)	3.15 (8.9)	(8.3)
	UW	2.26 (4.1)	2.32 (4.4)	(4.2)	3.83 (13.7)	3.94 (14.5)	(14.1)
Durum wheat	W	1.76 (2.1)	1.81 (2.3)	(2.2)	2.57 (5.6)	2.75 (6.6)	(6.1)
	UW	2.02 (3.1)	2.09 (3.4)	(3.2)	3.24 (9.5)	3.39 (10.5)	(10.0)
Barley (6-row)	W	1.61 (1.6)	1.70 (1.9)	(1.7)	2.39 (4.7)	2.47 (5.1)	(4.9)
	UW	1.92 (2.7)	2.0 (3.0)	(2.8)	2.95 (7.7)	3.03 (8.2)	(7.9)
Barley (2-row)	W	1.45 (1.1)	1.52 (1.3)	(1.2)	1.84 (2.4)	1.95 (2.8)	(2.6)
	UW	1.64 (1.7)	1.70 (1.9)	(1.8)	2.17 (3.7)	2.28 (4.2)	(3.9)
Raya	W	1.25 (0.58)	1.27 0.62)	(0.60)	1.40 (0.95)	1.41 (1.0)	(0.97)
	UW	1.29 (0.67)	1.32 (0.74)	(0.70)	1.54 (1.36)	1.56 (1.44)	(1.4)
Gobhi Sarson	W	1.43 (1.06)	1.46 (1.15)	(1.1)	1.82 (2.3)	1.87 (2.5)	(2.4)
	UW	1.59 (1.53)	1.67 (1.8)	(1.7)	2.10 (3.4)	2.17 (3.7)	(3.5)
Linseed	W	1.70 (1.9)	1.78 (2.2)	(2.0)	2.37 (4.6)	2.53 (5.4)	(5.0)
	UW	2.05 (3.2)	2.12 (3.5)	(3.3)	2.91 (7.5)	3.11 (8.7)	(8.1)
CD (P=0.05)		0.13	0.15		0.37	0.35	

Values in parentheses are original values; data is transformed to $\sqrt{x+1}$ transformation (sq. root)

mental field was sandy loam in texture, neutral in soil reaction ,low in organic carbon(0.39%) and having medium fertility with respect to N, P and K status. The available N was determined by Modified alkaline potassium permanganate method

(Subbiah and Asija, 1956), available P (0.5 N sodium bicarbonate extractable P method by Olsen *et al,* 1954), available K(Lang's Flame photometer by (Jackson, 1967) The experiment consisted of seven different rabi crops like bread wheat (variety PBW343), durum wheat (PDW275), six-rowed barley (PL-426), two-rowed barley (DWR 28), *Raya* (RLM619), *Gobhi sarson* (GSL-1) and linseed (LC-2023), each with two weed management practices i.e. weeded(W) and unweeded (UW).

RESULTS AND DISCUSSION

Weed population: Weed population was more in second year as compared to first year (Table 1).On average basis, at 60 days after sowing, maximum weed population was observed in bread wheat, followed by durum wheat, linseed, six-rowed barley and two-rowed barley under two hand weedings and unweeded control. Minimum weed population was found in *brassica* family crops i.e. *raya* and *gobhi sarson.* The results are in accordance with Grodzinsky (1992) who observed that *brassica* family crops in rotations reduced the weed populations up to 40 percent. Similar results were reported by Buhler *et al*, (1999) that *brassica*, Sava medic and berseem clover generally reduced lambs quarter weed population more than 80 percent.

Weed plant height: Weed plants growing in oilseed crops ecosystem were shortest in height in comparison to wheat, linseed and barley ecosystems because oilseed crops showed more vigorous growth than other crops (Table 2& 5). The findings of the study are supported by Al-Khatib and Boydston (1999) who reported that *brassica* spp. (*B.hirta, B.juncea, B. nigra and B.napus*) suppressed weeds through early vigorous growth and smothered weeds before they establish.

Weed dry matter accumulation: Among different *Rabi* crops, least weed dry matter accumulation was observed in *brassica* family crops as they suppressed weeds to a greater extent. Similar findings about weed suppression effect were reported by De Haan *et al.,* 1994, who observed that Yellow mustard (*Brassica hirta* moench) which was sown as a smother crop in corn for 6 to 8 weeks reduced weed biomass by an average of 82 percent. The *brassica* crop planted in autumn and incorporated before planting of next crop in spring reduced weed biomass by 50-60 percent (Boydston and Hang, 1992).

Crop yield: In all *Rabi* crops, the yield obtained was more under hand weeding treatments in comparison to unweeded plot which is in uniformity with the results reported by Solie *et al, 1991* in wheat. Singh and Saha (2001) also observed minimum weed biomass and maximum grain yield under hand weedings treatment.

Table 3. Grain/seed yield and straw yield of different *rabi* crops as influenced by weed control treatments.

Treatment		Grain yield (q ha^{-1})			Straw yield (q ha^{-1})		
		I year	IIyear	Mean	I year	IIyear	Mean
Bread wheat	W	45.3	43.1	44.2	62.3	58.4	60.3
	UW	40.0	37.8	38.9	54.0	50.8	52.4
Durum wheat	W	40.7	38.5	39.6	61.6	58.2	59.9
	UW	35.6	34.6	35.1	53.1	52.0	52.5
Barley (6-row)	W	30.0	32.3	31.1	57.9	60.5	59.2
	UW	25.0	31.1	28.0	51.4	57.7	54.5
Barley (2-row)	W	35.1	38.5	36.8	65.8	68.4	67.1
	UW	32.2	34.9	33.5	58.0	62.3	60.1
Raya	W	19.1	18.5	18.8	95.2	88.2	91.7
	UW	17.7	17.2	17.4	89.9	83.0	86.4
Gobhi Sarson	W	17.5	17.1	17.3	100.5	95.6	98.0
	UW	16.0	15.6	15.8	95.9	92.3	94.1
Linseed W		14.0	13.8	13.9	49.6	48.9	49.2
	UW	12.5	12.3	12.4	47.0	46.2	46.6

Table 4. Effect of different smothering crops on M.neglecta and crop yield.

Treatment		Mean weed dry matter at harvest(q/ha)	Mean grain/ seed yield(q/ha)	% reduction in crop yield of UW over W	% increase in weed dry matter of UW over W
Bread wheat	W	8.3	44.2	-	-
	UW	14.1	38.9	11.9	70
Durum wheat	W	6.1	39.6	-	-
	UW	10.0	35.1	11.3	64
Barley(6-row)	W	4.9	31.1	-	-
	UW	7.9	28.0	9.9	61
Barley(2-row)	W	2.6	36.8	-	-
	UW	3.9	33.5	8.9	50
Raya	W	0.97	18.8	-	-
	UW	1.4	17.4	7.4	44
Gobhi sarson	W	2.4	17.3	-	-
	UW	3.5	15.8	8.6	46
Linseed	W	5.0	13.9	-	-
	UW	8.1	12.4	10.8	62

Table 5. Periodic plant height of different *rabi* crops as influenced by weed control.

Treatments		Plant height(cm) 90 DAS			At Harvest		
		I year	II year	Mean	I year	II year	Mean
Bread wheat	W*	31.1	30.5	30.8	87.2	84.9	86.0
	UW**	30.7	29.6	30.1	84.9	81.1	83.0
Durum wheat	W	41.7	39.8	40.7	80.8	79.5	80.1
	UW	39.5	38.7	39.1	79.9	78.9	79.4
Barley (6-row)	W	59.1	56.7	57.9	90.5	86.0	88.2
	UW	58.4	56.1	57.2	88.4	85.2	86.8
Barley (2-row)	W	64.3	62.0	63.1	100.0	97.0	98.5
	UW	62.0	60.6	61.3	99.0	97.0	98.0
Raya	W	166.0	159.9	162.9	198.9	193.5	196.2
	UW	163.7	157.5	160.6	196.0	192.0	194.0
Gobhi Sarson	W	83.8	78.0	80.9	201.4	195.0	198.2
	UW	79.7	73.4	76.5	197.4	194.0	195.7
Linseed	W	42.7	36.6	39.6	115.6	111.5	113.5
	UW	42.1	35.1	38.6	113.0	109.0	111.0

* Hand weeding twice, **Unweeded (control)

To find out the smothering potential of different *Rabi* crops in suppressing the *M. neglecta,* a relation was worked out in yield of different crops and weed dry matter under treatment of two hand weeding and unweeded control. Minimum per cent reduction in yield of unweeded over weeded as well as minimum per cent increase in weed dry matter of unweeded plot over weeded was observed in *raya* crop as compared to all other crops(Table 4). Among different *Rabi* crops, *raya* showed maximum smothering potential followed by *gobhi sarson.* These findings are in line with the findings of *Sarmah et al*. (1992), who determined the smothering effect of 11,10 and 8 accessions of *Brassica juncea, Brassica napus* and *Brassica*

carinata, respectively on winter weeds of north east India under field conditions. Grimmer and Mausinas (2004) also observed that *brassica spp*. can establish quickly and smothers weeds during autumn months. Al -Khatib *et al* (1997) reported that *Brassica* crops suppressed the weed growth for several weeks or months. Plant extract combination of *brassica*-sunflower- sorghum presented 80% weed suppression, which equals to a sole application of synthetic herbicides (Mahmood *et al* 2015).

Conclusion

It is concluded that *raya* showed maximum smothering potential, *Gobhi sarson* was the next best followed by barley (2-row), barley (6-row), linseed, durum wheat and bread wheat, respectively in suppressing the *M. neglecta.* Two hand weeding treatment proved better in reducing the weed dry matter accumulation thereby increased the yield in comparison to unweeded control.

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