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Suitable cropping system and weed management practices for higher fodder oat production

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ABSTRACT

Field experiments were carried out during 2009-10 and 2010-11 at Mountain Livestock Research Institute, Manasbal, Sher-e-Kashmir University of Agricultural Sciences and Technology Kashmir, India to find out the suitable weed management practices and cropping system of fodder oat. The green fodder yield and dry matter accumulation of oat was significantly higher under oat sole than oat + vetch (2:1) and oat + vetch (1:1), however was at par to oat + vetch 4:1. The magnitude of increase in green fodder yield with oat sole was 0.96, 12.71 and 15.51% than 4:1, 2:1 and 1:1 cropping system, respectively. Application of pendimethalin 0.75/ha recoded 7.76, 24.46 and 98.6% superiority over application of butachlor 2 kg/ha, wheel hoe and weedy check, respectively. The oat sole with application of pendimethalin 0.75/ha recorded highest gross profit (₹ 76,903/ha), net returns (₹ 49,363/ha) and B:C (2.79) than other treatment combination.

Key words: Butachlor, Cropping system, Fodder oat, Green fodder yield, Pendimethalin, Wheel hoe

The fodder production in India is insufficient to meet the requirements of growing livestock population and country faces a net deficit of 61.1% in green fodder, 21.9% in dry crop residues and 64% in feeds (Agarwal *et al*. 2008). The shortage of feed and fodder has resulted in low productivity of Indian livestock (Tripathi *et al.* 2009). The fodder cultivation is equally or more remunerative than grain, cash or commercial crops (Agarwal *et al*. 2008). In Jammu & Kashmir, 0.6 lakh ha is under cultivated fodder crops (DES 2008) and faces a net deficit of 19% in fodder (Anonymous 2006). Among the cultivated *Rabi* fodder crops, oat is one of the promising fodder crop as it fits well in rice based cropping sequence. In Kashmir valley, a large number of weed species have been reported that are associated with fodder oat crop like *Ranunculus muricatus, R. arvensis*, *Fumaria indica*, *Arenaria serpyllifolia, Poa annua* among the highly frequent species (Reshi *et al*. 1986 and Singh *et al.* 2007). Besides other factors, weed infestation is one of the significant factors limiting the productivity and quality of fodder oat. Since the information available on weed management practices in fodder oat is limited in Kashmir, the present investigation was initiated to find out appropriate cropping system and weed management practice for higher fodder oat production.

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MATERIALS AND METHODS

The present investigation was conducted during *Rabi* seasons of 2009-10 and 2010-11 at Mountain Livestock Research Institute, Manasbal, Sher-e-Kashmir University of Agricultural Sciences and Technology, Kashmir to detect suitable cropping system and weed management practice for higher fodder oat production. The study area falls in temperate climatic zone of north western Himalaya. The experimental soil was clay loam in texture, neutral in reaction (pH 7.1), high in organic carbon (2.1%) and medium in available P (17.3 kg/ha), available K (414 kg/ha) and low in available N (156 kg/ha). The experiment was laid out in a split plot design with four cropping systems, *viz.* oat + vetch (4:1), oat (*Avena sativa*) + vetch (*Vicia villosa*) (2:1), oat + vetch (1:1), oat (sole) in main plot and four weed control methods, *viz*. weedy, wheel hoe, pendimethalin 0.75 kg/ha and butachlor 2.0 kg/ha to subplot with three replications having 15 m^2 gross plot size of each treatment. Oat cultivar '*Sabzar*' was sown with row to row spacing of 25 cm in pots receiving sole oat treatment. The winter vetch cultivar '*Golder Tares*' was sown after every four rows of oat in oat + vetch 4:1 treatment. In treatment oat + vetch 2:1, after every two rows of oat, one row vetch was sown and in oat + vetch 1:1, every row of oat was followed by one row of vetch. The spacing between oat and vetch was kept same as that of sole oat treatment (25 cm row-row) in all intercrop treatments.

The wheel hoe was operated twice in the season, one at 30-35 days after sowing and second at 160-165 days after sowing. The pendimethalin 0.75 kg/ha and butachlor 2.0 kg/ha were applied within three days after sowing to respective plots. No weed management practice was done in weedy check plots. The plant samples were taken at the time of harvesting for estimation of dry matter. Oat was harvested at milking stage and at the same time winter vetch was also harvested. The green fodder yield was estimated from 10.4 m^2 net plot area of each treatment.

RESULTS AND DISCUSSION

Weed flora

The weed flora observed in the experimental plots were: *Lamium amplexicaule,Galium aparine, Asperugo procumbense, Bromus japonica, Medicago polymorpha, Lolium perenne, Adonis aestivalis, Fumaria indica, Scandix pecten-veneris, Lithospermum arvense, Ranunculus arvensis, Cynodon dactylon, Arenaria serpyllifolia, Poa annua* and *Capsella bursa.*

Effect on weed biomass

The different cropping system and weed control methods induced significantly distinction in weed biomass, dry matter accumulation and green fodder yield of oat (Table 1). Among the cropping system oat + vetch (4:1) recorded significantly lower weed dry matter than oat + vetch (2:1), oat + vetch (1:1), however was at par to oat sole. Further, the oat sole recorded significantly lower weed dry matter than oat + vetch (2:1), oat + vetch (1:1). The difference between oat + vetch (2:1) and oat + vetch (1:1) was not significant with respect to weed dry matter. This trend may be ascribed to non-smoothening effect of winter vetch in replacement series of oat - vetch intercropping system. Among the weed control methods, application of pendimethalin 0.75 kg/ha recorded significantly lower weed dry weight than butachlor 2.0/ha, wheel hoe and weedy check. Application of butachlor 2.0 kg/ha recorded significantly lower weed dry matter than wheel hoe and weedy. Besides, wheel hoe was significantly superior than weedy with respect to weed dry matter. Pisal and Sagarka (2013) also reported that pre-emergence pendimethalin resulted efficient control of monocot and dicot weeds.

Effect on green fodder yield and dry matter

The green fodder yield and dry matter accumulation of oat was significantly higher under oat sole than oat + vetch (2:1) and oat + vetch (1:1), however was at par to oat + vetch 4:1. Further, oat + vetch 4:1 was superior to oat + vetch (2:1) and oat + vetch (1:1) with respect to green fodder yield and dry matter accumulation, though the difference between oat + vetch (2:1) and oat + vetch (1:1) was not significant. The oat sole recorded 0.96%, 12.71% and 15.51% increase in green fodder yield than 4:1, 2:1 and 1:1 cropping system, respectively. Lower biomass per unit area of winter vetch than oat may be the basis of higher dry matter accumulation and green fodder yield with sole oat. Application of pendimethalin 0.75 kg/ha was significantly superior with respect to green fodder yield and dry matter accumulation than other weed control treatments, and was followed by butachlor 2.0 kg/ha, wheel hoe and weedy. In turn, application of butachlor 2.0 kg/ha recorded significantly higher green fodder yield and dry matter accumulation than wheal hoe and weedy and further, wheel hoe was significantly superior than weedy check. Mishra *et al.* (2012) also found that application of pendimethalin 0.5 kg/ha was good in

Table 1. Effect of intercropping and weed control methods on weed dry matter, green fodder yield, dry matter accumulation of fodder oat

Treatment	Weed dry matter (g/m^2)			Green fodder (t/ha)			Dry matter (t/ha)		
	2009-10	2010-11	Mean	2009-10	2010-11	Mean	2009-10	2010-11	Mean
Cropping system									
Oat+vetch (4:1)	50.1	48.0	49.1	28.89	27.28	28.09	8.99	8.81	8.87
Oat+vetch (2:1)	60.5	58.1	59.3	25.87	24.45	25.16	7.71	7.44	7.57
Oat+vetch (1:1)	57.0	54.7	55.9	25.27	23.84	24.55	7.66	7.24	7.45
Oat sole	50.7	48.7	49.7	29.16	27.55	28.36	9.72	9.14	9.43
LSD (P=0.05)	4.37	4.22	4.26	1.30	0.83	0.85	0.86	0.54	0.65
Weed control method									
Wheel hoe	49.5	47.6	48.6	27.14	25.62	26.36	8.76	8.16	8.46
Pendimethalin 0.75g/ha	35.8	34.4	35.1	33.74	31.88	32.81	10.42	10.07	10.27
Butachlor 2.0g/ha	41.6	40.0	40.8	31.33	29.61	30.47	9.61	9.35	9.48
Weedy check	91.2	87.6	89.4	16.98	16.05	16.52	5.19	5.09	5.14
LSD (P=0.05)	4.62	4.42	4.48	1.36	1.11	1.14	0.52	0.56	0.52

weed control and produced higher grain yield of maize. Application of pendimethalin 0.75/ha recorded 7.8, 24.5 and 98.6% superiority over application of butachlor 2 kg/ha, wheel hoe and weedy check, respectively. Higher fodder yield with application of pendimethalin 0.75/ha was also reported by Bar *et al.* (1991) and Bhilare *et al*. (2001).

Economics

The oat sole with application of pendimethalin 0.75 kg/ha recorded highest gross profit (₹ 76,903/ha), net return (₹ 49,363/ha) and B:C (2.79) than other treatment combination (Table 2) and was followed by oat sole + butachlor, pendimethalin (4:1), butacholr (4:1) and lowest was recorded with weedy sole and weedy (4:1). It was concluded that fodder oat crop sown as sole with application of pendimethalin 0.75 kg/ha was found superior both with respect to green fodder production and economically.

Table 2. Relative economics of different treatment combinations

Treatment	Cost of cultivation (x10^3`/ha)	Gross returns (x10^3`/ha)	Net returns (x10^3`/ha)
Wheel hoe (4:1)	29.19	60.84	31.65
Pendimethalin (4:1)	28.44	69.41	40.97
Butachlor (4:1)	27.97	66.10	38.13
Weedy (2:1)	28.40	33.89	5.49
Wheel hoe (2:1)	30.27	49.34	19.07
Pendimethalin (2:1)	29.50	59.35	29.85
Butachlor (2:1)	29.43	53.84	24.41
Weedy (1:1)	29.15	43.32	14.17
Wheel hoe (1:1)	30.40	46.93	16.53
Pendimethalin (1:1)	30.65	56.84	26.19
Butachlor (1:1)	30.18	54.23	24.05
Weedy (sole)	26.04	26.55	0.51
Wheel hoe (sole)	28.54	53.83	25.29
Pendimethalin (sole)	27.54	76.90	49.36
Butachlor (sole)	27.07	69.60	42.53
Weedy check (4:1)	26.94	28.38	1.44

Input - Oat seed = ₹16/kg; Vetch seed = ₹ 250/kg; N = ₹ 11.95/kg; P_2O_5 = ₹ 24.0/kg; K_2O = ₹ 9.0/kg; Pendimethalin = ₹ 500/litre; Butachlor = ₹ 30/kg; Output Green fodder = ₹ 2.0/kg

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