Indian Journal of Agronomy **58** (4): 603–606 (December 2013)

Research Paper

Productivity of fodder oat (*Avena sativa*) under different sowing times, fertility levels and cutting management in temperate environment

INTIKHAB AALUM JEHANGIR[1], H.U. KHAN[2], T. MUBARAK[3], S. SHERAZ MAHDI[4] AND FAISAL-UR- RASOOL[5]

Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Shalimar, Srinagar, Jammu and Kashmir 191 121

Received : March 2012; Revised accepted : September 2013

ABSTRACT

In Jammu and Kashmir there is acute shortage of fodder for livestock husbandry particularly during winter. To improve the productivity of animals availability of adequate quantity of nutritive fodder is a prerequisite. An experiment was conducted during the winter (*rabi*) seasons of 2009–10 and 2011–12 at Srinagar on silty clay loam soil, to study the effect of different sowing times, fertility levels and cutting management on fodder production potential of oat (*Avena sativa* L.). The treatments consisted of 3 sowing dates, viz. 20 September, 30 September and 10 October; 3 fertility levels, viz. 150 kg N + 30.8 kg P + 33.3 kg K, 125 kg N + 26.4 kg P + 24.9 kg K and 100 kg N + 22 kg P + 16.6 kg K/ha; and 2 cutting management, viz. single cut at 50% flowering and double cut on 15 December and 50% flowering stage. Highest green fodder (37.3 t/ha) and dry-fodder yield (10.2 t/ha) were recorded with 30 September sown crop, which was at par with crop sown on 20 September. Net returns (₹33,858/ha) and benefit: cost ratio (1.96) were higher with crop sown on 30 September. Application of 150 kg N + 30.8 kg P + 33.3 kg K/ha recorded significantly higher green fodder (36.2 t/ha) and dry fodder yield (10.2 t/ha). Net returns (₹32,990/ha) and benefit: cost ratio (1.83) also improved with this treatment. Among cutting management practices, double cut recorded significantly higher green and dry fodder yields than single-cut practice. Double-cut practice registered higher net returns (₹30,634/ha) and benefit: cost ratio (1.7).

Key words: Cutting management, Fertility levels, Oat, Sowing time

The productivity of animals in India, especially milch animals, is very low as compared to developed countries, primarily due to less availability of nutritive feed and fodder to animals (Patel *et al.,* 2011). The estimated requirement of green and dry fodder in the country is 1,400 and 950 million tonnes, respectively, against the corresponding availability of 250 and 440 million tonnes (Chotiya and Singh, 2005). The scenario is not different in Jammu and Kashmir state, where fodder requirement is about 4.31 million tonnes against the availability of 3.26 million tonnes and, this indicates deficit of 1.05 million tonnes on dry matter basis SKUAST-K (2008). In the valley temperate zone, farmers experiences a long lean period of winter from December to ending February, when no green fodder is available to the livestock, thereby resulting in the drastic decrease in milk and meat production. The only available fodder for the livestock in winter is paddy straw and maize stover with very low nutritive value. If made available during the lean period, green fodder may improve productivity of farm animals. There is a need to develop agronomic practices for enhancing the availability of fodder in the valley. Hence, present experiment was conducted to assess the fodder production potential of oat under different sowing times, fertility levels and cutting management practices.

MATERIALS AND METHODS

A field experiment was conducted in a permanent site during the winter season of 2009–10 and 2010–11 at the Research farm, Kashmir (34°.05'N 74°.89'E, 1,587 m bove mean sea-level). Soil was silty clay loam, having 0.9% coarse sand, 14.2% fine sand, 50.0% silt and 34.9% clay with pH 6.89, organic carbon 0.89%, available nitrogen 261.48 kg/ha, available phosphorous 20.83 kg /ha and available potassium 165 kg /ha. The precipitation was 383.70 and 428.10 mm during the cropping season of

Based on part of Ph.D. Thesis of first author submitted to SKUA&T-Kashmir during 2012 (Unpublished)

[1]Corresponding author Email: drtasneem.mubarak@gmail.com
[3]Research Scholar, [2]Former Associate Professor, [5]Research Scholar, Division of Agronomy, SKUAST-K, Jammu and Kashmir; [3]Subject Matter Specialist (Agronomy), Krishi Vigyan Kendra, Anantnag (Pombay), Jammu and Kashmir 192 233; SKUAST-K; [4]Assistant Professor (Agronomy), Agricultural University Sobour, Bihar;

2009–10 and 2010–11 respectively. The experiment was laid out in factorial randomized block design, having 18 treatment combinations with three replications. The treatments comprised 3 sowing dates, viz. 20 September, 30 September and 10 October; 3 fertility levels, viz. 150 kg N + 30.8 kg P + 33.3 kg K, 125 kg N + 26.4 kg P + 24.9 kg K and 100 kg N + 22 kg P + 16.6 kg K/ha and 2 cutting management, viz. single cut at 50% flowering and double cut on 15 December and 50% flowering stage. The oat variety used was 'sabzar' a selection from 'UPO 212'. Light pre sowing irrigation was given during both the years. Half dose of nitrogen and full dose of phosphorus and potassium were applied to each plot as per treatment through urea, di-ammonium phosphate, and muriate of potash, respectively as basal. Remaining half dose of nitrogen was applied in 2 equal splits, i.e. 30 days after sowing (DAS) and first week of March, each after weeding. Ten random plants were selected from each plot, excluding the border row, for taking observation on plant height. The number of tiller/m row length at marked spots in penultimate rows of each plot was counted and converted into tillers/m^2. Leaf-area index was recorded using canopy analyzer. Representative plant samples from 25 cm-row length in penultimate rows were oven dried to record dry weight. The fresh fodder yield from net plots, leaving border and penultimate rows, was recorded immediately after the harvest of crop, which was then sun-dried separately and weighed for dry fodder yield. Economics was worked out using prevailing market prices of inputs and produce.

RESULTS AND DISCUSSION

Growth attributes

The growth attributes, viz. plant height, tiller number, leaf-area index, dry-matter accumulation and leaf: stem ratio, of oat were significantly affected due to sowing dates. Sowing on 30 September being at par with sowing on 10 October proved superior to sowing on 20 September for most of these characters (Table 1). These might be due to favourable environmental conditions during the crop period and better regeneration of crop growth after winter in these treatments. These findings are in line with the results of Alam *et al.* (2005) and El-Lattief (2011). Tiller production showed a fluctuation over crop period (Fig. 1) with September 20 sown crop registering significantly higher value over rest of the treatments up to 120 days after sowing. However, reverse situation was observed at harvest. This might be attributed to more senescence of tillers due to shading in earlier sown crop near harvest.

Growth parameters improved with the increase in fertility level (Table 1; Fig. 2). Plant height, tiller number, leaf-area index, dry-matter accumulation and leaf: stem ratio were significantly higher with application of 150 kg

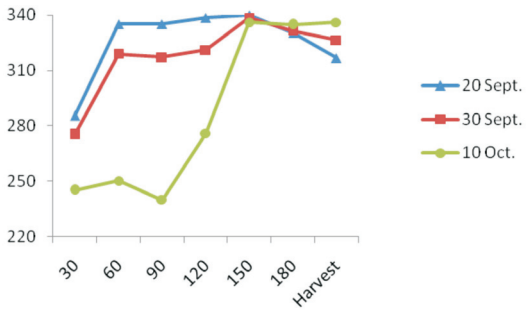

Fig. 1. Effect of sowing dates on periodic number of tillers.

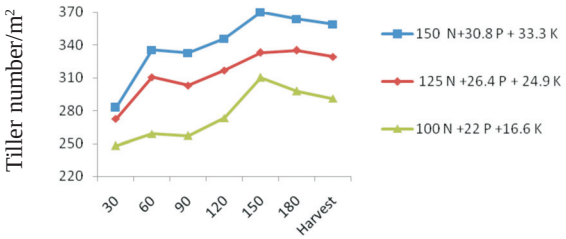

Fig. 2. Effect of fertility levels on periodic number of tillers.

N + 30.8 kg P + 33.3 kg K/ha. This may be attributed to increased protoplasmic constituents and accelerated cell division and elongation due to supply of sufficient nitrogen, better crop establishment in presence of adequate phosphorus, which directly governs the energy relation of crop plants and is responsible for better root development. Higher levels of potassium might have increased the availability of nitrogen and phosphorus owing to their synergistic effect. These results corroborate the findings of Bali *et al.* (2003).

Over the season, cutting management influenced the growth parameters. Single cut at 50% flowering recorded significantly higher plant height, tiller number, leaf-area

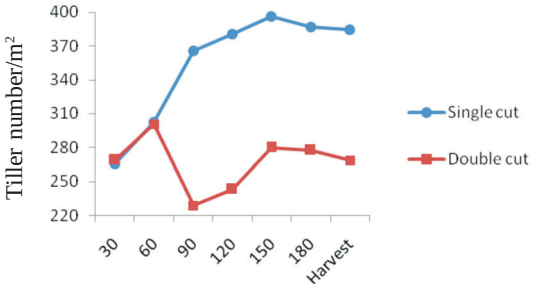

Fig. 3. Effect of cutting management on periodic number of tiller.

index and dry-matter accumulation (Table 1; Fig. 3). This might be due to better plant growth in terms of plant height, tiller number and leaf-area index and secondly continuous vertical growth of the crop ultimately reflected in higher dry-matter production. Sharma and Bhunia (2001) also reported similar findings.

Fodder yield

Sowing dates significantly influenced the green and dry fodder yield (Table 2), which remained at par between crop sown on 20 September and 30 September. Sowing on 10 October, however, caused marked reduction in fodder yield. This could be attributed to less production of forage in the first cut owing to lower temperatures at early growth stage in late-sown crop compared to early-sown crop. Green and dry fodder yield declined by 42.7% and 17% under this treatment over 30 September sown crop respectively. Sood *et al.* (1992) also reported higher forage yield

Table 1. Crop growth and fodder yield of oat as influenced by sowing date, fertility levels and cutting management at harvest (pooled data of 2 years).

Treatment	Plant height (cm)	Leaf-area index	Leaf: stem ratio	Dry-matter (t/ha)	Green fodder yield (t/ha)	Dry fodder yield (t/ha)
Sowing date						
20 September	78.89	3.97	0.49	6.76	37.08	10.06
30 September	107.63	5.43	0.59	6.95	37.28	10.23
10 October	109.62	5.22	0.54	7.20	26.12	8.18
SEm±	1.91	0.14	0.45	0.11	0.43	0.14
CD (P=0.05)	5.52	0.43	NS	0.32	1.24	0.40
N-PK kg/ha						
150 + 70 + 40	105.66	5.44	0.61	7.36	36.20	10.20
125 + 60 + 30	99.63	5.08	0.58	7.03	33.94	9.51
100 + 50 + 20	90.82	4.15	0.43	6.53	30.34	8.75
SEm±	1.91	0.14	0.04	0.11	0.43	0.14
CD (P=0.05)	5.52	0.43	0.13	0.32	1.24	0.40
Cutting level						
Single cut	110.86	5.58	0.52	7.76	31.07	9.25
Double cut	86.54	4.19	0.56	6.18	35.92	9.72
SEm±	1.51	0.09	0.02	0.07	0.35	0.11
CD (P=0.05)	4.50	0.35	NS	0.26	1.01	0.32

Table 2. Fodder quality and economics of production of oats as influenced by sowing dates, fertility levels and cutting management (pooled data of 2 years).

Treatment	Crude Protein (%)	Crude fiber(%)	Ash (%)	Cost of cultivation (₹/ha)	Net returns (₹/ha)	Benefit: cost ratio
Sowing date						
20 September	8.49	22.71	8.94	17,277	33,018	1.91
30 September	8.56	22.55	9.29	17,277	33,858	1.96
10 October	8.81	22.00	9.23	17,277	23,603	1.37
SEm±	0.06	0.18	0.07	-	-	-
CD (P=0.05)	0.18	0.52	0.20	-	-	-
N,-P,K kg/ha						
150 + 70 + 40	8.90	22.31	9.63	17,990	32,990	1.83
125 + 60 + 30	8.59	22.40	9.31	17,277	30,298	1.75
100 + 50 + 20	8.37	22.55	9.08	16,563	27,187	1.64
SEm±	0.07	0.19	0.06	-	-	-
CD (P=0.05)	0.19	NS	0.17	-	-	-
Cutting level						
Single cut	8.46	23.02	9.61	17,276	28,979	1.68
Double cut	8.77	21.82	9.04	17,991	30,634	1.70
SEm±	0.05	0.12	0.04	-	-	-
CD (P=0.05)	0.16	0.38	0.13	-	-	-

in early sowing oat compared to late sowing, which they attributed to availability of congenial temperature for better growth and development of crop in the former.

Green and dry fodder yield showed significant and consistent increase with increase in fertility level from lower to higher (Table 2). Application of 150 kg N + 30.8 kg P + 33.3 kg K/ha showed significantly higher green fodder and dry fodder yield. The better development of almost all the growth parameters with this treatment might have favoured increase in green and dry fodder yield. Increase in green and dry fodder yield was to the tune of 19% and 16.6% over 100 kg N + 22 kg P + 16.6 kg K/ha, respectively.

Double-cutting management practice recorded significantly higher green and dry fodder yield compared to single cutting management (Table 2). This may be attributed to the fact that the double-cutting practice in addition to the supply of fodder at 50% flowering stage, provided a good quantity of fodder in December. Singh and Dubey (2007) also recorded higher green and dry fodder yield in double-cut than single-cut crop. The magnitude of increase in green and dry fodder yield was 15.6% and 5%, respectively over single cut crop.

Quality

Among the sowing dates 10 October-sown crop recorded higher crude protein content, lower crude fibre and ash content (Table 3) during both the years. Since protein content is inversely proportional to fibre content, there was decrease in fibre content in 10 October-sown crop compared to other treatments. Similarly, lower ash content might be due to higher moisture content and lower dry-matter yield under this treatment. Increase in fertility level improved crude protein and ash content. This could be attributed to vigorous and luxuriant vegetative growth with higher nitrogen content in the plant tissues. These results corroborate the findings of Namgyal (2009). Crude fibre content remained non-significant among all the treatments. The fertility level 150 kg N + 30.8 kg P + 33.3 kg K/ha registered significant improvement in the ash content over lower fertility levels. These results are in conformity with those of Bhilare and Joshi (2007). Double-cut management practice recorded significantly higher crude protein content than single cut crop. However, crude fiber and ash content was significantly higher in single cut.

Economics

Net returns and benefit: cost ratio were higher with crop sown on 30 September (Table 2), followed by crop sown on 20 September. Application of 150 kg N + 30.8 kg P + 33.3 kg K recorded the highest net returns and benefit: cost ratio over rest of the fertility levels. Double-cut management practice fetched higher net returns. This treatment also gave higher benefit: cost ratio over single-cut management.

Thus, under temperate conditions of Kashmir valley, higher productivity and profitability of oat 'Sabzar' can be achieved by sowing the seed on 30 September, applying 150 kg N + 30.8 kg P + 33.3 kg K/ha and following double cut management practice.

REFERENCES

Alam, M.Z., Haider, S.A. and Paul, N.K. 2005. Effects of sowing time and nitrogen fertilizer on barley (*Hordeum vulgare*). *Bangladesh Journal of Botany* **34**(1): 27–30.

SKUAST-K. 2008. Status paper on fodder production in the state of Jammu and Kashmir. *41st RCM* (*Rabi* 2008), SKUAST-K, Shalimar.

Bali, A.S., Wani, M.A. and Shah, M.H. 2003. Growth and grain yield of Oat (*Avena sativa* L.) as influenced by varying row spacing and fertility levels. *SKUAST Journal of Research* **5**: 217–21.

Bhilare, R.L. and Joshi, Y.P. 2007. Productivity and quality of oat (*Avena sativa*) in relation to cutting management and nitrogen levels. *Indian Journal of Agronomy* **52**(3): 247–50.

Chotiya, Anshu and Singh, P. 2005. Effect of graded levels of nitrogen and phosphorus on sorghum fodder Production. *Forage Research* **31**(3): 218–19.

El-Lattief, E.A. Abd. 2011. Growth and fodder yield of forage pearl millet in newly cultivated land as affected by date of planting and integrated use of mineral and organic fertilizers. *Asian Journal of Crop Science* **3**(1): 35–42.

Namgyal, D. 2009. 'Integrated nutrient management in fodder maize with cowpea intercrop and its residual effect on succeeding oats crop'. *PhD. thesis*, Division of Agronomy, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar p. 63.

Patel, T.U., Arvadia, M.K., Malik, P.K., Patel, D.D. and Patel, P.S. 2011. Production of oats (*Avena sativa*) under different cutting management and split application of nitrogen. *Indian Journal of Agronomy* **56**(2): 164–67.

Sharma, S.K. and Bhunia, S.R. 2001. Response of oat (*Avena sativa*) to cutting management, method of sowing and nitrogen. *Indian Journal of Agronomy* **46**(3): 563–67.

Singh, S.D. and Dubey, S.N. 2007. Soil properties and yield of fodder oat (*Avena sativa* L.) as influenced by sources of plant nutrient and cutting management. *Forage Research* **33**(2): 101–03.

Sood, B.R., Singh, R. and Sharma, V.K. 1992. Effect of sowing dates and cutting management in forage yield and quality of oat (*Avena sativa*). *Forage Research* **18**(2): 130–34.