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RELATIVE PERFORMANCE OF DUAL PURPOSE OAT AND BARLEY GENOTYPES FOR GREEN FODDER AND SEED YIELD IN ARID RAJASTHAN

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SUMMARY

Sixteen genotypes of barley and eight genotypes of oat were evaluated for green fodder and seed yield during **rabi** 2012-13 at Agricultural Research Station, Keshwana, Jalore (Rajasthan). Green fodder yield of oat genotypes ranged between 56.00 and 130.33 q/ha with the average of 94.28 q/ha; however, in barley it varied between 119.50 and 238.50 q/ha with the average of 178.70 q/ha at 53 days after sowing. The seed yield of regenerated oat varied between 6.98 and 20.57 q/ha with the average yield of 14.50 q/ha; and in barley it ranged between 19.79 and 47.43 q/ha with the average of 31.29 q/ha. This high degree of variability among genotypes of oat and barley revealed a good scope of selection. Genotypes OS-387, JO-09-504, JHO-2012-5, JHO-822 and UPO-212 of oat and RD-2035, BH-971, Azad, UPB-1035, UPB-1036, UPB-1034, RD-2715 and RD-2552 of barley appeared relatively better for green fodder and seed yield in dual purpose cultivation. Relative performance of these two species revealed that plant height and green fodder yield of fresh crop and seed yield of regenerated crop were higher in barley; however, plant height and biological yield of regenerated crop were found higher in oat. Total income received from green fodder, seed and straw yield of barley was Rs. 104262.00/ha, whereas it was Rs. 81710.00 in oat. Therefore, cultivation of dual purpose barley was found more profitable than oat in arid Rajasthan.

Key words : Barley, dual purpose, genotypes, green fodder, oat, seed yield, varieties

Oat (*Avena sativa* L.) and barley (*Hordeum vulgare* L.) are important dual purpose cereals cultivated for animal fodder and grain production. These crops are grown during winter season in north-western and central India and are now extending to the eastern region also. Barley is mainly cultivated for grain which is consumed as feed and raw material in beverage industries. It is also grown as fodder for animals (Verma *et al*., 2005; Sharma, 2002, 2007). Oat is mainly cultivated as fodder for animals and also for grain because of its high nutritional and medicinal value. The use of its grain is now more focused on mining its benefits as a health food. The importance of oats in the biochemical and cosmetic industry is also on the rise (Tiwari and Cummins, 2009). Oat production has continuously decreased, whereas the demand of oat as a human food has increased because of its dietary benefits of the whole grain and β-glucan content (Buerstmayr *et al*., 2007). Oat is now being preferred as a "functional food" as it is rich source of fibres and also has antioxidant properties (Nirmalakumari *et al.,* 2013).

Looking to the situation of fragmented and small land holdings, efforts are going on to develop high yielding varieties for dual purpose cultivation (Singhal *et al.,* 2008) so that farmer can get green fodder and food grain from the same crop in the same season. Oat and barley have excellent growth, biomass production and quick regeneration after cutting. The potential of both the crops has been recognized for dual purpose cultivation, where regenerated crop is managed for seed production after first fodder cut. Therefore, selection of suitable varieties attains a paramount importance in harnessing the higher fodder and seed yield. Oat and barley improvement programme in India is successfully developing commercial varieties for dual purpose cultivation in different agro-ecological situations. Present experiments were conducted with the objective to test the potential of oat and barley genotypes for better

production and profitability under dual purpose cultivation in arid Rajasthan.

MATERIALS AND METHODS

Two separate field experiments were conducted during winter (**rabi**) season of 2012-13 at the experimental farm of Agricultural Research Station, Keshwana, Jalore. The site is situated at latitude of 25°22′N and longitude of 72°58′E, elevation 162 msl and has a tropical arid climate with mean annual rainfall of 421 mm. Soil at the site was clay loam slightly saline in reaction (pH 8.7) and low in organic carbon (0.23%). Before the experiment was established, the field was planted with clusterbean crop during preceding **kharif** season.

A total of 16 genotypes of barley and eight genotypes of oat received under All India Coordinated Research Programme were evaluated in a randomized block design. Barley genotypes were evaluated with four replications and oat genotypes with three replications. Both the experiments were sown on 21 November 2012. Plot size was kept as 2.5 x 4.0 m accommodating 4 m long 10 rows per plot at 22.50 cm row distance with seed rate of 100 kg/ha. A fertilizer dose of N 80 and P 40 kg/ha was applied. A half dose of N and full dose of P_2O_5 were applied at the time of sowing in the form of urea and DAP, respectively. The remaining half dose of the N was top dressed in the form of urea in two splits at tillering stage of fresh crop and 10 days after fodder cut in regenerated crop. The additional spray of 1.0% soluble NPK (19 : 19 : 19) at flowering and grain formation stages of regenerated crop was also applied to harness the potential seed yield. Total seven flood irrigations, each of about 6 cm depth, were applied according to the requirement of the crop. Two hand weedings were carried out at 25 days after sowing and 15 days after fodder cut to have the crop free from weeds. Fodder cut was taken at 53 days after sowing and regenerated crop managed for grain production. Data recorded for green fodder, biological yield and seed yield, etc. were analyzed using standard analysis of variance (ANOVA) technique.

RESULTS AND DISCUSSION

Performance of Oat Genotypes

Differences among genotypes for plant height and green fodder yield of fresh crop at 53 days after sowing; and plant height, biological yield and seed yield of regenerated crop were found statistically significant. Green fodder yield of different genotypes ranged between 56.00 and 130.33 q/ha with the average of 94.28 q/ha, and maximum was found in RO-19 followed by OL-1709 and OL-1775 with green fodder yield of 122.67 and 116.67 q/ha, respectively (Table 1). Seed yield of regenerated crop varied between 6.98 and 20.57 q/ha with the average yield of 14.50 q/ha. This high degree

TABLE 1
Green fodder and seed yield of different genotypes of dual purpose oat

Genotype	Fresh crop		Regenerated crop			
	Plant height (cm)	Green fodder (q/ha)	Plant height (cm)	Biological yield (q/ha)	Seed yield (q/ha)	1000-seed weight (g)
OL-1709	48.89	122.67	108.33	91.03	13.07	22.37
RO-19 ©	53.44	130.33	107.33	91.67	6.98	28.17
JHO-2012-5	38.88	77.67	106.67	88.03	15.80	26.57
UPO-212 ©	40.22	88.67	99.33	93.00	15.61	27.20
OS-387	27.77	76.67	106.67	87.03	20.57	26.60
JO-09-504	46.66	90.67	97.33	73.00	18.60	35.20
OL-1775	50.66	116.67	112.67	78.33	10.38	22.40
JHO-822 ©	43.22	87.67	90.67	72.67	17.02	36.53
JHO-2012-4	24.11	56.00	86.00	83.20	13.63	37.00
NDO-1709	48.77	95.83	107.67	92.67	13.38	33.07
Mean	42.26	94.28	102.27	85.06	14.50	29.51
S. Em.±	1.67	4.59	3.19	3.66	0.94	0.91
C. D. (P=0.05)	4.96	13.64	9.51	10.87	2.79	2.71
C. V. (%)	6.84	8.43	5.42	7.45	11.23	5.35

of variability in growth and production of genotypes revealed a good scope of selection for dual purpose cultivation. Results indicate that, in general, genotypes accumulated higher biomass at early stage were poor in seed yield in regenerated crop.

Among checks, varieties JHO-822 and UPO-212 appeared to be appropriate for dual purpose cultivation in arid Rajasthan. Other genotypes OS-387, JO-09-504 and JHO-2012-5 seemed to be most promising for dual purpose cultivation in arid Rajasthan. Nirmalakumari *et al.* (2013) also reported variability for fodder yield and yield attributing traits in oat genotypes.

Performance of Barley Genotypes

Differences among barley genotypes for plant height and green fodder yield of fresh crop and plant height, biological yield and seed yield of regenerated crop were found statistically significant (Table 2). Green fodder yield of barley genotypes ranged between 119.50 and 238.50 q/ha with the average of 178.70 q/ha, and maximum was found in RD-2859 followed by RD-2715 and RD-2857 with green fodder yield of 219.50 and 209.25 q/ha, respectively. Seed yield of regenerated crop varied between 19.79 and 47.43 q/ha with the average of 31.29 q/ha, and maximum was found in RD-2035 followed by BH-971with 42.37 q/ha. Results indicated that plant height was an important character contributing to fodder and biological yield of barley. A perusal of results also indicated that, in general, genotypes accumulated higher biomass at early stage were poor in seed yield in regenerated crop.

Therefore, looking to the green fodder of fresh crop and seed yield of regenerated crop, genotypes BH-971 and UPB-1036 appeared to be the most productive and appropriate for dual purpose cultivation in arid Rajasthan. Among checks, maximum green fodder of 219.50 q/ha was provided by RD-2715 followed by RD-2552, RD-2035 and Azad with 186.25, 163.50 and 155.25 q/ha, respectively. However, in regenerated crop, maximum seed yield of 47.43 q/ha was provided by RD-2035 followed by Azad, RD-2715 and RD-2552 with 39.78, 31.23 and 30.49 q/ha, respectively. Kaur *et al.* (2009) and Pal and Kumar (2009) also reported significant differences among barley genotypes evaluated for dual purpose cultivation.

TABLE 2
Green fodder and seed yield of different genotypes of dual purpose barley

Genotype	Fresh crop		Regenerated crop			
	Plant height (cm)	Green fodder (q/ha)	Plant height (cm)	Biological yield (q/ha)	Seed yield (q/ha)	1000-seed weight (g)
RD-2859	73.98	238.50	68.25	51.75	25.54	48.93
RD-2552 ©	59.65	186.25	66.75	69.75	30.49	40.25
RD-2035 ©	58.48	163.50	76.50	92.05	47.43	40.85
UPB-1036	60.08	190.00	88.75	87.38	37.35	33.68
RD-2715 ©	65.16	219.50	78.50	64.25	31.23	46.30
UPB-1034	54.58	156.50	82.00	71.25	35.69	36.45
BH-971	52.58	186.75	82.00	93.75	42.37	48.18
KB-1238	57.50	180.25	62.25	47.00	19.79	40.60
BH-970	50.83	138.50	71.50	73.50	28.04	39.50
RD-2858	64.75	187.25	73.75	56.50	27.93	51.60
NDB-1570	64.15	175.25	76.75	50.75	23.41	41.08
UPB-1035	48.41	119.50	83.25	97.45	38.38	36.03
RD-2857	74.40	209.25	72.00	46.10	22.19	50.85
AZAD ©	59.15	155.25	92.00	91.00	39.78	45.48
RD-2856	64.08	191.00	72.25	52.50	25.80	50.28
NDB-1566	57.74	162.00	82.50	82.25	25.19	40.90
Mean	60.35	178.70	76.81	70.45	31.29	43.18
S. Em. ±	3.58	11.59	2.32	3.83	1.48	1.31
C. D. (P=0.05)	10.20	33.03	6.61	10.92	4.24	3.75
C. V. (%)	11.87	12.98	6.05	10.88	9.51	6.10

Relative Performance of Oat and Barley under Dual Purpose Cultivation

The plant height and green fodder yield of barley at 53 days after sowing were 42.80 and 89.54 per cent higher over oat, which indicated that growth and biomass production ability of barley at early stage was higher than oat (Table 3). In regenerated crop, seed yield and test weight of barley were 115.79 and 46.32 per cent higher over oat. However, plant height and biological yield of regenerated oat were 23.96 and 20.73 per cent higher than barley. It indicated that regeneration capacity of oat was better than barley but seed production potential of barley was much higher than oat. Economic analysis revealed that total income received from green fodder, seed and straw yield of barley was Rs. 104262.00/ha, however, in case of oat, it was Rs. 81710.00. Therefore, the cultivation of dual purpose barley appeared to be more beneficial than oat and an additional income of Rs. 22552/ha might merely be earned if barley was cultivated in place of oat. Francia *et al.* (2006) reported higher biomass production of barley than oat in dual-purpose systems in Mediterranean Italy. Sharma (2002) reported green and dry fodder yield superiority of barley over oat.

TABLE 3
Relative performance of oat and barley under dual purpose cultivation

S. No.	Attributes	Oat	Barley
1.	Plant height at 53 days after sowing (cm)	42.26	60.35
2.	Green fodder yield at 53 days after sowing (q/ha)	94.28	178.70
3.	Plant height of regenerated crop at maturity (cm)	102.27	82.50
4.	Biological yield of regenerated crop (q/ha)	85.06	70.45
5.	Seed yield of regenerated crop (q/ha)	14.50	31.29
6.	Straw yield of regenerated crop (q/ha)	70.56	39.16
7.	1000-seed weight of regenerated crop (g)	29.51	43.18
8.	Total income from green fodder, seed and straw yield (Rs./ha)	81710	104262

Market rate : Green fodder–Rs. 150/q, oat seed Rs.–3200/q, barley seed Rs.–2100/q and straw Rs.–300/q.

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