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Association Ships and Influence of Productive Attributes on Yield of Oat (*Avena sativa L.*)

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Abstract

An experiment was carried out to know the variability of different oat entries, Association ship & influence of productive parameters on yield during 2022-23 at JNKVV research farm, College of Agriculture Tikamgarh , Madhya Pradesh. In the light of foregoing result and discussion it can be concluded the entries having higher/highest values of yield, (HWO-87,HWO-78,HWO-52 and HWO-61) can be retained for further breeding programme to evolve high yielding variety. Data on correlation coefficient stated that thousand grain weight, plant height, productive tillers /meters and flag leaf with influenced the yield positively all though the values were non-significant ,while days to heading, flag leaf length, number of grain /spike length and days to maturity correlated with yield negatively. The path analysis revealed that length of flag leaf (0.739), width of flag leaf (0.039) and plant height (2.520) had direct positive influence on grain yield while productive tiller/m2 (-1.226) days to heading (-1.182), No of grain/spike days to maturity (-1.015) and 1000 grain might (-0.981) showed negative indirect effect.

Keywords: Oat, phenotypic association, genotypic association, direct and indirect effects.

Introduction

Oats (Avena sativa L.) originated from Mediterranean region, is an important dual (grain and fodder) purpose annual crop of rabi season. It belongs to family poaceae and ranks sixth in production among all cereal crops next to wheat, maize, rice, barley and sorghum in the world scenario. Among the oats genomes, white oats (Avena sativa) and red oats (Avena byzantiana) are cultivated. All over the world, oats was cultivated over 10.29 million hectares with a production of 20.49 million tonnes. The major oats growing areas are between 40^0 and 60^0 N latitudes (Asia, Europe and North America), whereas a small proportion of production originates from southern hemisphere also (South America, Australia and New Zealand). Oats (2n=6x=42) is a natural allopolyploid evolved through cycles of interspecific hybridization and polyploidization combining three distinct genomes are A. sterilis, A. fatua and A. sativa. In recent years, oats production has continuously decreased, whereas the demand for oats for human consumption as food has increased because of dietary benefits of whole grain (Achleitner et al., 2008). Improvement of yield and yield components has been the prime objective of breeders besides quality traits and agronomic traits in evolving high yielding oats varieties.

Oat is rich in energy, protein, vitamin B, phosphorus and iron. The nutritive value of oat forage is high and showed to have dry matter digestibility in excess of 75% when fed to dairy cattle Burgess et al. (1972). Cereal straws have similar chemical compositions but oat straw has higher digestibility organic matter content (Cuddeford, 1995). Oat

straw is soft and more acceptable to livestock than other cereal straws. The health benefits of oats have only recently been acknowledged. The above attributes offer new opportunities for improvement of oat as a green-feed crop for intensively farmed grazing animals, and as a dual purpose crop for resource-poor farmers. It is, therefore, timely to contemplate what oats have to offer at the beginning of the new millennium. Thus the present study was undertaken to estimate the variability in germplasm and other standard varieties of Avena sativa sp for different fodder and grain yield characters viz. Days to Heading, Flag Leaf (cm), Flag Width (cm), Productive Tillers / M^2, Plant Height Cm, No of Grains / Spike, Grain Yield / Plant (g), Days to Maturity, Thousand Grain Weight (g), Grain Yield / Plot (kg) and Bio Yield / plot (Kg). However, to obtain a clear picture of the inheritance pattern of different grain yielding attributes the present experiment was under taken to evaluate the variability in forage Oat (Avena sativa L.) and to find out the genotypic and phenotypic correlations between grain yield and its components and also between the component. Assessment of the genetic variability can be achieved using morphological measurements and phenotypic characterization (Greene et al., 2008). Hence, evaluation of the existence of genetic variability for various yield components and analysis of correlation between various characters towards improvement of yield were taken as the prime objectives of the present study.

Materials and Methods

The field experiment was conducted at the JNKVV, College of Agriculture Tikamgarh, Madhya Pradesh, during 2022-23. The experimental material for present investigation comprised 11 diverse forage genotypes of oat (*Avena sativa L.*) The experiment was conducted in randomized block design (RBD) with 3 replications. The plot size for each genotype in each replication was 6.0 m × 1.80 m. Each plot accommodated 06 rows of 6m length at a distance of 30 cm from Row to Row. The fertilizer schedule, irrigation and other cultivation aspect were adopted as per recommendations for commercial cultivation of fodder oat. In each plot of three replications, five plants were selected randomly. For collecting data on Days to Heading, Flag Leaf (cm), Flag Width (cm), Productive Tillers / M^2, Plant Height (cm), No of Grains / Spike, Grain Yield / Plant (g), Days to Maturity, Thousand Grain Weight (g), Grain Yield / Plot (kg) and Bio Yield / plot (Kg). in each replication. The genotypic and phenotypic variances, genotypic and phenotypic coefficient of variances were estimated according to the formula suggested by Singh and Choudhary (1985) genetic advance were estimated according to the formula suggested by Johnson et al. (1955).

Results and Discussion

To know the genotypic values for yield and its traits of eleven Oat genotype was recorded and analyzed statistically. The perusal of data revealed that highest value for days to heading was recorded for entries HWO-61, HWO-65, HWO-118 and V-8 (87) while it was lowest (81) for HWO-52. In case of flag leaf length variation significantly highest value was measured for entries HWO-109, HWO-65 and V-8 (29cm) where as its width varies between 1.2 to 2.0 cm. Highest flag leaf width was measured for entry HWO-52

(2.0 cm) where in lowest value was in HWO-113 (1.2).

Productive tillers are the major trait to assess the resultant yield and maximum productive tillers were produced by entry HWO-68 (162) followed by HWO-52 (155) and HWO-65 (145) while it was least recorded for HWO-61 (65). Plant height was ranged between 105 to 132 cm and it was highest and it was highest in HWO-52 (132 cm) and was least for HWO-65 (105). Grain/spike varies between 62 to 142 and maximum number of grain/spike was counted for entry V-8 (142) followed by HWO-109 and HWO-113. Days to maturity ascertains the earliness or late maturing entry which also indicate who much days taken for grain growth period more number of days taken by entry V-8 (119days) followed by HWO-65 and HWO-114 where as lesser days taken for maturity by entry HWO-61 (99).

Thousand grain weight is also an important yield characters contributes towards yield. Heavier seed was observed for entry HWO-52 and HWO-65 (35g) while least thousand grain weight was recorded for two entries ie HWO-114 and HWO-113 (20g). Biological yield is the index sows distribution of dry mater translocation towards sink that is grain. So the heist biological yield was weighted for entry HWO-87 (11.50kg) while it was lowest of 9.5 kg /ha was recorded for HWO-118.Grain yield is the ultimate expression of cumulative effects of productive parameters they contributes positively and significantly and the highest yield per plot was recorded for entry HWO-87 (5.6kg/plot) followed by HWO-78 (5.04kg/plot) and HWO-52 (5.09 kg/plot) while it was recorded lowest for entry V-8 (4.21kg/plot). Entries having higher/highest values of yield, (HWO-87, HWO-78,HWO-52 and HWO-61) can be retained for further breeding programme to evolve high yielding variety.

Table 1 Mean genotypic values for yield and its attributes in oats

Entries	Days to Heading	Flag Leaf (cm)	Flag Width (cm)	Productive Tillers / M^2	Plant Height cm	No of Grains / Spike	Grain Yield / Plant (G.)	Days to Maturity	Thousand Grain Weight (g)	Grain Yield / Plot (kg)	Bio Yield / plot (Kg)
HWO-52	81	25	2.0	155	132	106	15	113	35	5.090	11.00
HWO-61	87	22	1.8	65	115	93	14	99	30	5.050	10.00
HWO-65	87	29	1.3	145	105	66	11	118	35	4.550	10.00
HWO-68	85	24	1.3	162	115	86	12	116	25	4.900	11.00
HWO-78	83	21	1.5	125	112	94	14	113	20	5.040	11.00
HWO-87	79	25	1.7	130	117	98	15	95	30	5.600	11.50
HWO-109	80	29	1.5	112	130	135	12	96	25	4.580	11.00
HWO-113	86	24	1.2	105	125	120	12	114	20	4.290	10.00
HWO-114	85	23	1.5	122	108	116	12	116	20	4.590	10.50
HWO-118	87	27	1.6	105	112	62	10	117	25	4.300	9.50
V-8	87	29	1.8	95	115	142	11	119	25	4.210	10.00
Mean	84.27	25.27	1.56	120.09	116.91	101.64	12.18	110.55	26.36	4.75	10.50
Min.	80	21	1.2	65	105	62	10	95	20	4.210	9.50
Max.	87	29	2.0	162	132	142	15	119	35	5.60	11.50

Peterson et al (2005) revealed that for the yield enhancement and optimization ,traits with higher values related with positively with yield are to be screened out. So that these characters can be in corporate in the further breeding programme for higher yield. Therefore to know the characters which influencing yield positively should be screened out by means of correlation analysis. The analyzed data on correlation coefficient stated that thousand grain weight, plant height, productive tillers /meters and flag leaf with influenced the yield positively all though the values were non-significant ,while days to heading, flag leaf length, number of grain /spike length and days to maturity correlated with yield negatively. These findings corroborated with the findings of Yanming (2006) and Buerstamayr (2007) accordingly Redaelli et al .(2008) stated that seed yield is positively correlated with the grain yield.

Path coefficient analysis is a tool to bifurcate correlation coefficients into direct and indirect affects which influence yield positively or negatively for the same path coefficient analysis was carried out (ILewey and LU 1959) to divide correlation coefficient into direct and indirect effect. The path analysis revealed that length of flag leaf (0.739), width of flag leaf (0.039) and plant height (2.520) had direct positive influence on grain yield while productive tiller/m2 (-1.226) days to heading (-1.182), No of grain/spike days to maturity (-1.015) and 1000 grain might (-0.981) showed negative indirect effect. these findings are in conformity with the findings of Yang (1986), Moradi el al (2005) and Bibi et al (2012) found that negative direct effect were observed for 1000 kernel Weight and number of productive tillers etc.

Table 2. Simple correlation coefficients among yield and its components in oats

Entries	Days to Heading	Flag Leaf (cm)	Flag Width (cm)	Productive Tillers / M^2	Plant Height cm	No of Grains / Spike	Grain Yield / Plant (G.)	Days to Maturity	Thousand Grain Weight (g)	Grain Yield / Plot (kg)	Bio Yield / plot (Kg)
Days to Heading	1	0.111^{NS}	-0.057^{NS}	-0.512^{NS}	-0.540^{NS}	-0.322^{NS}	-0.702^{*}	0.736^{**}	0.031^{NS}	-0.616^{*}	-0.929^{**}
Flag Leaf (cm)		1	0.077^{NS}	0.012^{NS}	0.135^{NS}	0.161^{NS}	-0.457^{NS}	0.329^{NS}	0.433^{NS}	-0.470^{NS}	-0.181^{NS}
Flag Width (cm)			1	-0.236^{NS}	0.294^{NS}	0.138^{NS}	0.495^{NS}	-0.211^{NS}	0.464^{NS}	0.392^{NS}	0.073^{NS}
Productive Tillers / M^2				1	0.012^{NS}	-0.301^{NS}	0.360^{NS}	-0.059^{NS}	0.296^{NS}	0.460^{NS}	0.633^{*}
Plant Height cm					1	0.524^{NS}	0.392^{NS}	-0.584^{NS}	0.174^{NS}	0.244^{NS}	0.422^{NS}
No of Grains / Spike						1	0.005^{NS}	-0.160^{NS}	-0.330^{NS}	-0.227^{NS}	0.215^{NS}
Grain Yield / Plant (G.)							1	-0.782^{**}	0.289^{NS}	0.963^{**}	0.767^{**}
Days to Maturity								1	-0.109^{NS}	-0.726^{*}	-0.659^{*}
Thousand Grain Weight (g)									1	0.387^{NS}	0.074^{NS}
Grain Yield / Plot (kg)										1	0.715^{*}
Bio Yield / plot (Kg)											1

Table 3 Estimation of direct and indirect effects of path coefficients analysis on grain yield in oats genotypes

Entries	Days to Heading	Flag Leaf (cm)	Flag Width (cm)	Productive Tillers / M^2	Plant Height cm	No of Grains / Spike	Grain Yield / Plant (G.)	Days to Maturity	Thousand Grain Weight (g)	Bio Yield / plot (Kg)
Days to Heading	**-1.182**	0.192	0.001	0.231	-0.709	0.543	0.513	-0.016	-0.063	0.154
Flag Leaf (cm)	-0.307	**0.739**	-0.003	-0.566	-0.205	-0.245	0.761	-0.537	-0.692	-0.050
Flag Width (cm)	-0.046	-0.053	**0.039**	-0.185	2.110	-0.173	-0.261	-0.016	-0.267	-0.158
Productive Tillers / M^2	0.222	0.338	0.006	**-1.226**	0.658	-0.023	0.878	-0.950	-0.110	-0.221
Plant Height cm	0.332	-0.060	0.032	-0.322	**2.520**	-0.912	-0.563	-0.003	-0.203	-0.238
No of Grains / Spike	0.528	-0.149	0.023	-0.022	1.891	**-1.215**	-0.551	0.221	-0.116	-0.177
Grain Yield / Plant (G.)	0.427	-0.396	0.007	0.764	0.999	-0.471	**-1.420**	0.838	0.154	0.016
Days to Maturity	-0.018	0.391	0.001	-1.157	-0.008	0.265	1.173	**-1.015**	-0.168	-0.134
Thousand Grain Weight (g)	-0.076	0.521	0.010	-0.139	0.522	-0.144	0.223	-0.174	**-0.981**	-0.006
Bio Yield / plot (Kg)	0.476	0.097	0.016	-0.717	1.569	-0.562	0.060	-0.355	-0.015	**-0.382**

In the light of foregoing result and discussion it can be concluded the entries showing higher yield and characters which are significantly positively and negatively correlated and had direct effect on yield should be treated as selection criteria and can be used for further breeding programme.

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