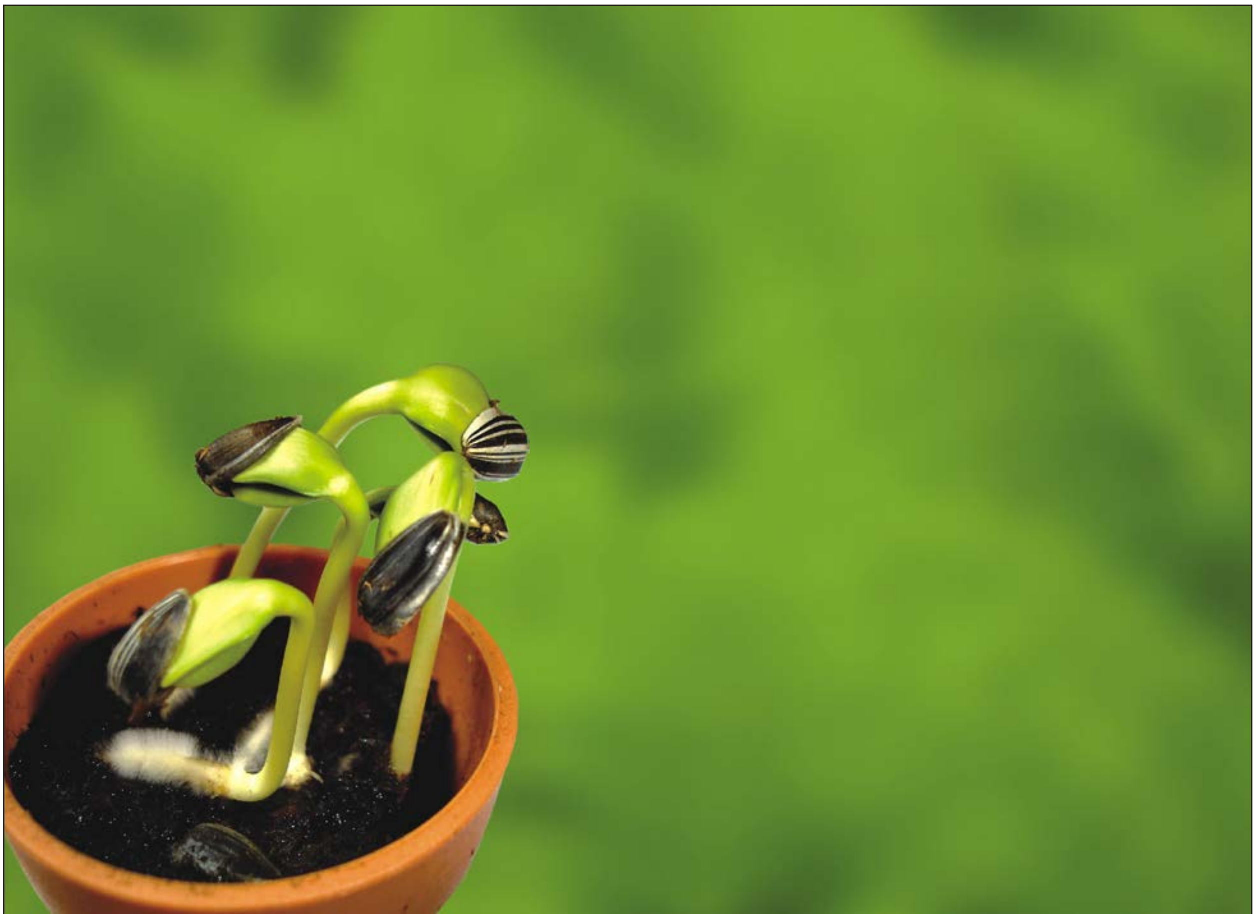

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Estimation of Correlation Coefficient in Oats (*Avena sativa* L.) for Forage Yield, Grain Yield and their Contributing Traits

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ABSTRACT

Genotypic correlation coefficients provide a measure of the genetic association among characters and give an indication of characters that could be useful so as to identify more important ones for a particular selection programme. Correlation studies were conducted to study the degree of interrelationship between forage yield, grain yield and their major contributing traits. Most important trait viz: green fodder yield plant^{-1} exhibited a significant positive genotypic correlation with number of leaves plant^{-1}, number of tillers m^{-1} row, plant height (cm), culm diameter (cm), leaf stem ratio, dry fodder yield plant^{-1} (g) and negatively significant correlation with crude protein content % and ADF%. Days to 50% flowering had negative significant association with Green fodder yield plant^{-1} and leaf stem ratio. Number of leaves plant^{-1} had a significant positive correlation with culm diameter, number of tillers m^{-1}, plant height and leaf stem ratio. Plant height had a significant positive correlation with leaf stem ratio, culm diameter and number of tillers m^{-1}. Crude protein content and acid detergent fibre showed significant negative association with green fodder yield which suggested that these traits cannot be simultaneously improved. Grain yield plant^{-1} exhibited significant and positive correlation coefficients with spike-lets panicle^{-1}, 1000 seed weight (g) and seed length breadth ratio but negative non significant correlation with protein content. These results will be beneficial in devising a selection scheme for identifying best genotypes possessing higher forage yield, grain yield and better quality.

Key words: *Avena sativa* L., correlation, green fodder yield, quality, seed yield

INTRODUCTION

In Jammu and Kashmir state, livestock population is 7.8 million and green fodder availability is not sufficient enough to meet the requirements of a burgeoning live stock population. Cultivation of high yielding fodder oat cultivar Sabzaar developed for temperate climate conditions of Kashmir valley has helped in increasing forage productivity but in order to further upscale productivity per unit area there is need to develop varieties having higher green forage yield potential and nutritional quality. The typical temperate climate of the valley of Kashmir associated with long winter results in acute shortage of fodder during these months. This shortage in further accentuated by great demand for fodder by cross-bred milch cattle being developed under intensive cattle development projects. Additionally shortage of cultivable area for raising fodder makes it imperative to raise the productivity per unit area. Cultivation of oats as a fodder crop during rabi season during the last two decades has become very popular. Only a few varieties of oats are available for cultivation and their fodder yields vary between 25-30 t ha^{-1} under good management conditions. Development of high yielding varieties of oats therefore, assumed greater importance. For scientific utilization of elite allelic resources present in the exotic gene pool of oats through hybridization and subsequent selection of recombinants possessing high fodder yields potential together with high quality, it is imperative to characterize these genotypes on scientific basis. It is believed that knowledge of the nature and magnitude of genetic association among components of economic worth can help in improving the efficiency of selection by making possible use of suitable combination of characters. The correlations are mostly reported to occur because of pleiotropic effects and/or linkages between the traits. In crop improvement, breeding value correlations are more useful, especially for indirect selection and this type of selection can be advantageous over direct selection, only when the selected trait has very high heritability and breeding value correlation between two traits is very high. The present study was therefore, conducted to estimate the relationship of different components traits towards forage and grain yield. The information will be of importance to oat breeders in future to follow oat breeding programs.

MATERIALS AND METHODS

The basic material for the present study consisted of ten diverse genotypes of Oats (*Avena sativa* L.) viz: SKO-204, SKO-205, SABZAAR, SKO-207, SKO-208, SKO-209, SKO-210, SKO-211, SKO-212 and SKO-213 selected from the germplasm collection maintained at Division of Plant Breeding and Genetics, SKUAST-K, Shalimar. Forty five F_1 crosses (excluding reciprocals) were generated through a 10×10 diallel mating design during rabi 2009-10 at SKUAST-K, Shalimar. The final experimental material comprised the ten parents and their forty five F_1's. The experiment was laid out in a completely randomized block design with three replications. The experimental plot comprised 2 rows each of 1 m length. Row to row and plant to plant spacing was maintained at 30 and 10 cm. The observations were recorded on the following characters viz: green fodder yield $plant^{-1}$, number of leaves plant^{-1}, number of tillers $metre^{-1}$ row, plant height (cm), culm diameter (cm), leaf stem ratio, dry fodder yield $plant^{-1}$ (g), spike-lets $panicle^{-1}$, 1000 seed weight (g), seed length breadth ratio, Grain yield $plant^{-1}$, protein content, Acid Detergent Fibre (ADF) and Neutral Detergent Fibre (NDF) using non-segregating generations (Parent+F_1,s).

Statistical method: The data were subjected to correlation coefficient analysis at genotypic levels according to the method proposed by Al-Jibouri *et al.* (1958) to calculate correlation coefficients between all the possible pairs of characters.

RESULTS AND DISCUSSION

The basic requirement of any selection programme is to ascertain the nature and magnitude of interrelationship between yield and its component traits, and also among the different traits. It was, therefore, considered imperative to carry out correlation studies for various quantitative traits that contributed to fodder and seed yield along with quality. The estimated genotypic correlation coefficients (Table 1), green fodder yield $plant^{-1}$ had a significant positive correlation with no of leaves $plant^{-1}$ (0.5423**), number of tillers m^{-1} row (0.3455**), culm diameter (0.5423**), plant height (cm) (0.3385**), leaf stem ratio (0.5644**), dry matter yield and negative significant association with acid detergent fibre and crude protein content. Dry matter yield had a significant

Table 1: Genotypic correlation coefficient between forage yield characters in non-segregating (parents+F_1,s) generation of oats (*Avena sativa* L.)

Characters	Days to 50% flowering	No. of leaves plant^{-1}	No. of tillers (m^{-1})	Culm diameter (cm)	Plant height (cm)	Leaf stem ratio	Green fodder yield plant^{-1}	Dry matter yield plant^{-1} (g)
Days to 50% flowering	-	-0.1330	-0.1278	-0.2094	-0.2171	-0.3644**	-0.2225*	0.1378
No of leaves plant^{-1}	-	-	0.4126**	0.5637**	0.2783**	0.2900**	0.5423**	0.2558**
No. of tillers (m^{-1})	-	-	-	0.2997**	0.2479**	0.2669**	0.3455**	0.1053
Culm diameter (cm)	-	-	-	-	0.2997**	0.5194**	0.5423**	0.1333
Plant height (cm)	-	-	-	-	-	0.6573**	0.3385**	0.5639**
Leaf stem ratio	-	-	-	-	-	-	0.5644**	0.1042
Green fodder yield plant^{-1}	-	-		-	-	-	-	0.2503**
Dry matter yield plant^{-1} (g)	-	-	-	-	-	-	-	-

Estimates based on pooled data over environments, *,**significant at 5 and 1% level of significance

Table 2: Genotypic correlation coefficient between seed yield characters in non-segregating (parents+F_1,s) generation of oats (*Avena sativa* L.)

Characters	Spike lets panicle^{-1}	1000 seed weight (g)	Seed length breadth ratio	Seed yield plant^{-1} (g)
Spike lets panicle^{-1}	-	-0.3105**	0.189	0.7562**
1000 Seed weight (g)	-	-	-0.1438	0.4406**
Seed length breath ratio	-	-	-	0.2468**
Seed yield plant^{-1} (g)	-	-	-	-

Estimates based on pooled data over environ, *,**,significant at 5 and 1% level of significance

positive correlation with plant height, green fodder yield. Days to 50% flowering had a significant negative association with green fodder yield plant^{-1} and leaf stem ratio. Number of leaves plant^{-1} had a significant positive correlation with culm diameter, green fodder yield plant^{-1}, number of tillers m^{-1}, plant height, leaf stem ratio and dry matter yield. Plant height had a significant positive correlation with leaf stem ratio, culm diameter and number of tillers m^{-1}. Number of tillers m^{-1} had a significant positive correlation with m^{-1}, culm diameter and leaf stem ratio. Culm diameter had a significant positive correlation with leaf stem ratio. Seed yield plant^{-1} (Table 2) had a significant positive genotypic correlation with spikelet's plant^{-1} (0.7562**), seed length breadth ratio (0.4406**) and 1000 seed weight (0.2468**). Spikelet's panicle^{-1} had a significant negative correlation with 1000 seed weight. These findings were in general agreement with the earlier reports of Akram *et al.* (2008), Khokhar *et al.* (2010) and Kalimullah *et al.* (2012). Based on these results it seems possible that simultaneous selection of these characters for improvement in forage and seed yield in the present set of material would be erective. The results clearly revealed a scope of simultaneous improvement of these traits through selection. Positive and significant correlation of plant height with leaf number suggested that taller plants would bear more leaves and therefore, would result in increased biomass production through selection (Choubey and Gupta, 1986). Increase in the number of tillers resulted in the increase in number of leaves but decrease in crude protein yield. Crude protein, acid detergent fibre and neutral detergent fibre studied as parameters of forage quality did not reveal significant positive association with any of the maturity, agronomic or yield traits. However, crude protein and acid detergent fibre showed significant negative association with green fodder yield. Similar results in oats have been reported by Ahmad *et al.* (2010). Crude protein content and acid detergent fibre showed significant negative association with green fodder yield which suggested that these traits cannot be simultaneously improved. Thus, need arises to resort to hybridization with subsequent selection. However, it is essential to determine the cause of correlation between the traits prior to embarking on such a strategy. If the correlation is due to linkage, it is ephemeral, whereas, correlation based on pleiotropic effects of genes are long lasting. If the character combination of high and low value is due to pleotropic effects, it would appear difficult to obtain the desired combination. If on the other hand, linkage appears to be the cause of the correlation then breeding procedures would be needed to maximize the opportunity for breaking up of linkage blocks to realize the desirable recombinant lines. Supporting evidences on such breakage of linkage and release of desirable variability through inter-mating has been provided by studies in wheat (Yunus and Paroda, 1982).

CONCLUSION

Correlation studies will be helpful in identifying high forage yielding transgressive segregants which will help in increasing the production and productivity per unit area and thus prove use full in bridging the ever increasing demand of green fodder in the valley. It was, therefore, suggested that number of leaves plant^{-1}, number of tillers metre^{-1} row, plant height (cm), culm diameter (cm), leaf stem ratio for seed yield, number of spike-lets per plant^{-1}, seed length breadth ratio and 1000 seed weight should be given emphasis for future forage and seed yield improvement programs. These results will be beneficial in devising a selection scheme for identifying best genotypes possessing higher forage, grain yield and better quality.

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