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**Theme 2.** Grassland production and utilization

**Sub-theme 2.6.** Interdependence of grassland and arable lands for sustainable cereal, forage and livestock production

## Sustainable quality fodder production under temperate mountain agriculture in Kashmir

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### Keywords

The parents and 45 F1 crosses (excluding reciprocals) in oats (*Avena sativa* L.) were analyzed genetically to generate information on forage quality, physiological parameters, green fodder yield plant<sup>-1</sup> (g) and grain yield plant<sup>-1</sup>(g) at SKUAST Kashmir, Shalimar, Srinagar, J&K (India) during winter (*rabi*) season 2011-2012. The highest crude protein content was recorded in SKO-208. The lowest NDF was observed in SKO-213. Lowest ADF was observed in SKO-204. Lowest crude fiber was observed in SKO-213. Highest ash content was observed in SKO-209. The highest chlorophyll content was recorded in SKO-211. The highest leaf area index was recorded in SKO-211. Eleven cross combination have been found desirable for all traits.

*Avena sativa* L., Quality parameters

### Introduction

Inadequate supply of quality feed and fodder is the primary cause of lower productivity of milch animals in India. Oats (*Avena sativa* L.) is an important fodder crop in J&K. Jammu and Kashmir state the fodder requirement is about 4.31 million tonnes against the available 3.26 million tonnes (Anonymous, 2008). Kashmir valley experiences a long lean period of winter, resulting in scarcity of green and quality fodder which results in drastic decrease in milk production. Therefore, to meet the need of animal products, there is a great importance of fodder cultivation to compensate fodder scarcity during lean period (*Rabi* crops remain dormant due to snow/ freezing temperatures). The best measure related to forage quality is animal productivity, which can be affected by nutrient intake, digestibility and utilization efficiency. Quality forage must have high intake, digestibility and efficient utilization. Physiological characteristics have significant impacts on growth and development of plants grown in production systems. Keeping the above facts in view, the present investigation was undertaken to identify the parents and their crosses for physiological and forage quality traits which are economically sustainable for forage yield and quality for sustainable consumption in hill agriculture.

### 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 and their 45 F<sub>1</sub> crosses (excluding reciprocals) generated through diallel mating design was evaluated for physiological traits, forage yield its quality and grain yield at the experimental farm of Div. of Plant Breeding, SKUAST-Kashmir, main campus Shalimar, Srinagar, J&K (India) during winter (*rabi*) season 2011-2012. . The quality parameters for which these genotypes were studied include Crude protein content (CP %) (Jackson, 1973), Neutral detergent fiber (NDF %) (Goering and Vansoest, 1970), Acid detergent fiber (ADF %), Estimation of ash % (AOAC, 1984) and Crude fiber % (Maynard, 1970). While among physiological traits, Leaf area index (LAI), using canopy analyzer (Acuapar LP-80). The chlorophyll content was measured with the help of chlorophyll meter (SPAD-502, Konica Minolta Sensing), conversion equations used to convert relative SPAD-502 values to leaf chlorophyll concentration (gm<sup>-2</sup>) Gandía *et al.*, 2007].

### Results and Discussion

The data presented in Figure 1 revealed that highest crude protein content (10.67%) of oats among parents was recorded in SKO-208 which was closely followed by SKO-213 (10.52%), SKO-209 (10.50) and SKO-204 (10.32%). As regards to fiber quality , the lowest ADF and NDF were exhibited by SKO-213 (31.8%) and SKO-204 (53.7), respectively, Similarly, the lowest crude fiber content was recorded in SKO-213 (22.80) followed by SKO-212 (24.40), SKO-207 (25.20) and SKO- 208 (25.4). Among the 10 genotypes, the highest ash content was observed in SKO-209 (6.90%) while SKO-212 showed the lowest ash content (6.20%). The estimates of forage quality parameters of 45 F1 hybrids were presented in Table 1. It is evident that, the cross combination SKO-212 x SKO-213 and SKO-210 x SKO -213 recorded the highest crude protein content whereas, the cross combinations SKO-205 x SKO-207 and SKO -204 x SKO-211 recorded the lowest range of ADF and NDF respectively. The cross combinations viz., SKO-207 x SKO-212 , SKO -207 x SKO-210 and SKO-210 x SKO-211 recorded the lowest crude fiber content , where as the cross combination SKO-205

× SKO-212 was found to be superior in terms of ash content. During the present study it was found that the genotypes SKO-205, SKO-208, SKO-212, SKO-210 and Sabzaar and the cross combinations SKO-205 × SKO-210, SKO-212 × SKO-213 recorded the highest amount of chlorophyll content (Figure 1). Among the 10 diverse genotypes and 45 cross combinations of Oat, the highest leaf area index was recorded in genotype SKO-211 which was closely followed by SKO-208, SKO-212, SKO-210 and SKO-213 while among cross combination . SKO-212 × SKO-213 and SKO-205 × SKO-210 recorded the highest LAI. Green fodder yield plant<sup>-1</sup> of 10 parents ranged from 112.1 to 185.13g. The highest green fodder yield was observed from SKO-205, SKO-212 and SKO-210, however, among the cross combinations, the crosses SKO-212 × SKO-213 and SKO-210 × SKO-211 recorded the highest green fodder yield plant<sup>-1</sup>. Similarly, the grain yield plant<sup>-1</sup> were found highest in genotypes SKO-208 and SKO-209 and the cross combinations SKO-207 × SKO-211 and SKO-211 × SKO-212 (Tables 1). Oat genotypes that are low in NDF and ADF should have good forage quality because low NDF is associated with high forage intake and low ADF is associated with high digestibility. Present study also revealed that, the parents and their cross combination with high chlorophyll content and LAI possesses high green forage and grain yield. These findings were in general agreement with the earlier reports of Xie *et al.*, (2011). Present study revealed that physiological yield-related parameters like LAI and chlorophyll content should be taken into consideration to develop high-yield oat genotypes.

### Conclusion

Parents SKO-208, SKO-207, SKO-213, and SKO-209 is identified as superior genotype for most of fodder quality parameters and yield and there is a need of further evaluation across diverse agro-ecological situations to confirm their higher forage yield and nutritional quality while eleven cross combinations have been found desirable with all traits. These cross combinations need critical evaluation during subsequent generation to identify desirable transgressive segregants for these traits. Genotypes with high chlorophyll content and LAI were used as selection criteria to improve oat cultivars with higher forage and grain yield.

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