

CHARACTERIZATION AND EVALUATION OF ONE AND TWO-HARVEST OF OATS

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SUMMARY

One hundred and eight germplasm accessions of oats randomly sampled from the five hundred germplasm accessions being conserved at CCS Haryana Agricultural University, Hisar. These were characterized and evaluated under one harvest and two harvest systems separately, for various morphological traits against two checks, namely, OS 6 and HJ 8 during **rabi** 2005-06. Wide range of genetic variability was recorded for green fodder yield/m row (650-1850 g) and for dry matter yield/m row (60-180 g), respectively, in one harvest. Six germplasm accessions, namely, HFO 314 (1850 and 180 g), HFO 239 (1800 and 160 g), HFO 46 (1800 and 150 g), HFO 273 (1700 and 150 g), HFO 291 (1600 and 160 g) and HFO 684 (1600 and 150 g) were found significantly higher in green fodder yield and dry matter yield as compared to the best check HJ 8 (1577 and 142 g), respectively, whereas under two harvest system, wide range in variability (70-275 g, 600-1800 g, 720-1960 g) was observed for GFY at 1st harvest, 2nd harvest and total of two harvests, respectively. Likewise, for DMY, wide range in variability was observed (30-85 g, 50-170 g, 85-220 g) in 1st cut, 2nd cut and total of two cuts, respectively. On the basis of total of the 1st and 2nd harvest, only three germplasm accessions, namely, HFO 338 (1960 g), HFO 635 (1865 g), and HFO 45 (1800 g) were found significantly better in GFY than the best check HJ 8 (1763 g), while only one accession, namely, HFO 338 (220 g) was found significantly better in DMY than the best check HJ 8 (196 g). It was interesting to note that all the three germplasm lines, namely, HFO 338 (117 days), HFO 635 (115 days) and HFO 45 (111days) which gave significantly higher GFY on total basis were also significantly early in 50 per cent flowering than the best high fodder yielding cultivar HJ 8 (119 days). The characterization of germplasm revealed that seven accessions had erect growth habit, 67 were semi-erect type and 36 were semi-prostrate type. Based on foliage colour, the germplasm was categorized into three classes, namely, light green (23 accessions), green (82 accessions) and dark green (5 accessions). Likewise, according to plant stature, the germplasm could be categorized into three classes, namely, dwarf (6 accessions), semi-dwarf (72 accessions) and tall type (32 accessions). According to market value of the oat crop, the germplasm was categorized into three classes i. e. grain type (48 accessions), dual type (38 accessions) and fodder type (24 accessions). On the basis of panicle shape, all the 110 accessions were categorized into two classes having equilateral panicle shape (61accessions), and non-equilateral or flag type panicle shape (49 accessions). Presence of awn was recorded in 70 accessions, while in 40 accessions it was absent.

Key words : Oat, germplasm, characterization and evaluation

The oat (*Avena sativa* L.) crop is widely cultivated for use as food, feed and fodder. It is rich in energy, protein, vitamin B, phosphorus and iron (Mehra, 1978). The crop is chiefly grown in North-Western, Central and Hilly parts of India due to suitable climatic conditions (Sharma *et al.*, 2001). Oat can be grown easily during winter months in hilly areas because of its drought and cold tolerance ability (Singh and Katoch, 1973). Its popularity as a fodder crop in the region is increasing because of its excellent growth habit, quick

regeneration ability, high palatability, succulence and high nutritive value for both milch as well as draft animals. Its cultivation is now extending to the eastern regions particularly in those tracts, which are suitable for wheat cultivation. It ranks sixth in the world cereal production following wheat, maize, rice, barley and sorghum. The bulk of the oats produced in the world are used for livestock feed (cattle, sheep, poultry and horses) and only 17 per cent of the world production (grain) is used as human food.

Genetic improvement of a crop depends upon the extent and magnitude of genetic variability present in the economic characters. Therefore, the evaluation, characterization and utilization of genetic variability in desired direction become extremely important in any yield improvement programme. In this regard, it is necessary to survey the valuable and useful variability present in the available genetic stock. Keeping in view the considerable national as well as global importance of the crop, the present study was carried out to estimate the relative genetic variability for some economic characters and to characterize the germplasm for some morphological characters, to identify the suitable germplasm accessions for further multiplication as cultivar development or for hybridization programme.

MATERIALS AND METHODS

The following experiment was conducted at the Research Farm of Forage Section, Department of Plant Breeding, CCS Haryana Agricultural University, Hisar, during **rabi** season of 2005-06. The farm is located about 4 km away from the main campus and situated at about 29°10' Latitude, 75°44' E Longitude, and at an Altitude of 228 m from sea level.

Evaluation and Characterization of Oats Germplasm

A random sample of 108 germplasm accessions of oat was taken from the 500 germplasm accessions available in the genetic stock being maintained at CCS Haryana Agricultural University, Hisar. These 500 accessions have been collected from various sources such as NBPGR, New Delhi; IGFRI, Jhansi and various SAU's and farmers' fields. These 108 germplasm accessions were grown in 12 blocks each containing nine germplasm lines. All these blocks had first line of check cultivar OS 6 and the last line of check cultivar HJ 8. Each line and check cultivar was sown in a 3 m row spaced 45 cm from row to row. Two separate experiments, one for single cut system and the other for 2-cut system were sown on 23 Nov. 2005. The data on green fodder yield/m row (g), dry matter yield/m row (g), days to 50 per cent flowering both under single cut as well as 2-cut system were recorded. The observations on some morphological traits were also recorded to characterize and categorize the germplasm on qualitative basis.

RESULTS AND DISCUSSION

Evaluation and Characterization of Oats Germplasm

Mean values, range in variation, coefficient of variation (%), and characterization and categorization for various traits of both the experiments are given in Tables 1 and 2. Very good information on sources of germplasm, various descriptors, data on various morphological traits, and characterization of oats germplasm on the basis of morphological traits has been well documented (Mathur, 1989; Choubey *et al.*, 2003). Likewise, Jhorar *et al.* (2004) have emphasized the importance of characterization and utilization of germplasm in oat improvement programme, while Roy and Choubey (2005) described the role of gene pool in genetic improvement of forage oats.

A. Evaluation of Germplasm

(i) Under 1-cut system : Wide genetic variability was observed for green fodder yield/m row (650-1850 g) and for dry matter yield/m row (60-180 g) with a population mean of 1205 and 112 g, respectively, and coefficient of variation (CV) of 21 and 22 per cent, respectively. However, low amount of variability was recorded for 50 per cent days to flowering (91-122 days, overall mean of 106 days and 7% CV). Six germplasm accessions, namely, HFO 314 (1850 and 180 g), HFO 239 (1800 and 160 g), HFO 46 (1800 and 150 g), HFO 273 (1700 and 150 g), HFO 291 (1600 and 160 g) and HFO 684 (1600 and 150 g) were significantly higher in green fodder yield and dry matter yield, respectively, as compared to the best check cultivar HJ 8 (1577 and 142 g).

Some accessions like HFO 46, HFO 243, HFO 684 and HFO 239 which gave high fodder yield were also early in flowering than the best fodder yielding check cultivar HJ 8 (113 days), whereas the highest fodder yielding accession HFO 314 was very late in 50 per cent flowering (121 days) as compared to the best yielding check cultivar HJ 8 (113 days). Het Ram *et al.* (2001) reported substantial amount of genetic variability for fodder and grain yield and also for root length in various species of oats.

(ii) Under 2-cut system : Wide range in variability (70-275 g, 600-1800 g and 720-1960 g), coefficient of variation (31, 22 and 20%) and population

TABLE 1
Evaluation of oat germplasm for fodder yield and days to heading under 1-cut and 2-cuts system

Character	Parameters				Best genotypes	Best check
	Mean		C. D. at 5% CV (%)			
	Range	C. D.	at 5%	CV (%)		
One-cut						
GFY (g/m row) one cut	1205	650-1850	10	21	HFO 46 (1800), HFO 239 (1800) HFO 243 (1700) HFO 251 (1600), HFO 314 (1850), HFO 581 (1600), HFO 684 (1600) HFO 685 (1640)	HJ 8 (1577)
DMY (g/m row) one cut	112	60-180	3	22	HFO 46 (150), HFO 239 (160), HFO 243 (150), HFO 291 (160), HFO 314 (180), HFO 338 (150), HFO 454 (150), HFO 511 (150), HFO 532 (150), HFO 684 (150), HFO 687 (160), HFO 773 (150)	HJ 8 (142)
Days to 50% heading (one cut)	106	91-122	2	7	HFO 148 (91 days)–Most early HFO 512 (140 days)–Most late	OS 6 (110) HJ 8 (113)
Two-cuts						
GFY (g/m row) 1 st cut	148	70-275	4	31	HFO 309 (275), HFO 429 (250)	HJ 8 (246)
GFY (g/m row) 2 nd cut	1148	600-1800	10	22	HFO 45 (1620), HFO 221 (1600), HFO 240 (1540), HFO 338 (1800), HFO 450 (1660), HFO 525 (1540), HFO 574 (1550), HFO 581 (1600), HFO 635 (1740), HFO 685 (1580)	HJ 8 (1517)
Total GFY (g/m row) of 1 st and 2 nd cut	1296	720-1960	10	20	HFO 45 (1800), HFO 338 (1960), HFO 635 (1865)	HJ 8 (1763)
DMY (g/m row) 1 st cut	42	30-85	2	23	HFO 113 (55), HFO 309 (60), HFO 388 (60), HFO 429 (60), HFO 511 (85), HFO 527 (55), HFO 574 (55)	HJ 8 (53)
DMY (g/m row) 2 nd cut	101	50-75	3	24	HFO 338 (170), HFO 450 (150), HFO 635 (150), HFO 770 (150)	HJ 8 (143)
Total DMY (g/m row) of 1 st and 2 nd cut	143	85-220	3	18	HFO 338 (220)	HJ 8 (196)
Days to 50% heading (two cuts)	111	99-123	1	6	HFO 402 & HFO 580 (99 days)–Most early HFO 314 & HFO 466 (123 days)–Most late	OS 6 (105) HJ 8 (119)

mean (148, 1148 and 1296 g) was observed for green fodder yield at 1st harvest, 2nd harvest as well on total basis, respectively. Likewise, for DMY, range in variability (30-85 g, 50-170 g and 85-220 g), coefficient of variation (23, 24 and 18%) and population mean (42, 101 and 143 g) was recorded at 1st harvest, 2nd harvest as well on total basis, respectively. Range in genetic variation (99-123 days), low coefficient of variation (6%) and population mean (111 days) was recorded for days to 50 per cent flowering. However, it was interesting to note that the estimates for all the parameters were high in the case of 2-cut system as compared to the single cut system.

At first harvest, only one germplasm accession HFO 309 (275 g) was significantly superior in GFY, while accession HFO 429 (250 g) was significantly at par with the best check variety HJ 8 (246 g).

At 2nd harvest, nine accessions, namely, HFO 338 (1800 g), HFO 635 (1740 g), HFO 450 (1660 g), HFO 45 (1620 g), HFO 581 and HFO 221 (1600 g), HFO 685 (1580 g), HFO 574 (1550 g), HFO 240 and HFO 525 (1540 g) were found significantly higher in GFY than the best check variety HJ 8 (1517 g).

However, on the basis of total yield of green fodder of 1st and 2nd cut, only three germplasm accessions, namely, HFO 338 (1960 g), HFO 635 (1865 g) and HFO 45 (1800 g) were significantly better than the best check variety HJ 8 (1763 g).

At 1st cut, four germplasm accessions, namely, HFO 511 (85 g), and HFO 309, HFO 388 and HFO 429 (60 g) were significantly superior in DMY than the best check HJ 8 (53 g), while at 2nd cut, four germplasm lines namely, HFO 338 (170 g), and HFO 450, HFO 635 and HFO 770 (150 g) were significantly better than the best check variety HJ 8 (143 g).

On the basis of total yield of dry matter of 1st and 2nd cut, only one germplasm line HFO 338 (220 g) was found significantly better than the best check variety HJ 8 (196 g). It was interesting to note that this line had highest GFY also.

All the three germplasm lines, namely, HFO 338 (117 days), HFO 635 (115 days) and HFO 45 (111 days) which gave significantly higher GFY on total basis were also significantly early in 50 per cent flowering than the best high fodder yielding cultivar HJ 8 (119 days).

B. Characterization of Germplasm

All the germplasm accessions including two check cultivars were morphologically characterized for Growth habit (E=Erect, SE=Semi-erect, SP=Semi-prostrate), leaf colour (LG=Light green, G=Green, DG=Dark green), awn (AP=Awn present, AA=Awn absent), market value (Grain type, fodder type and dual type) and plant stature (SD=Semi-dwarf, T=Tall, D=Dwarf), and classified into various categories based on different characters.

The germplasm accessions falling under each category are given in Table 2. Seven accessions were erect type, while 67 were semi-erect and 36 were semi-prostrate type. Based on foliage colour, the whole set of germplasm was categorized into three classes, namely, light green (23 accessions), green (82 accessions) and dark green (5 accessions). Likewise, according to plant stature, the germplasm accessions could be categorized into three classes, namely, dwarf (6 accessions), semi-dwarf (72 accessions) and tall type (32 accessions). According to market value of the oat crop, the whole sets of germplasm accessions were categorized into three classes i. e. grain type (48 accessions), dual type (38 accessions) and fodder type (24 accessions).

On the basis of panicle shape, all the 110 accessions were categorized into two classes having equilateral panicle shape (61 accessions) and non-equilateral or flag type panicle shape (49 accessions). Presence of awn was recorded in 70 accessions, while in 40 accessions it was absent.

TABLE 2
Morphological characterization and categorization of oat germplasm

Character	Categories	No. of accessions in each category
Growth habit	Erect	07
	Semi-erect	67
	Semi-prostrate	36
Leaf colour	Light green	23
	Green	82
	Dark green	05
Plant stature	Dwarf	06
	Semi-dwarf	72
	Tall	32
Market value	Grain	48
	Dual	38
	Fodder	24
Panicle shape	Equilateral	61
	Non-equilateral	49
Awn	Present	70
	Absent	40

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