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Suitability of forage crop with respect to physiology traits

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Abstract
A field trial was planted in Live Stock Farm, College of Agriculture, JNKVV, Jabalpur (M.P.) to ascertain the suitability as Cereal-fodder of Wheat, Barley and Oat crops with reference to their Physiological performance. This study was conducted for two years (2011-2013). The phenophasic phases - days to ear emergence, days to milking, days to physiological maturity and days to physical maturity studies revealed the better performance of wheat. There was a better increase of oat growth LAI (2.11), LAD (1677.19), SLA (199.87) and SLW (0.13).

Keywords: Wheat, Oat, Barley, Days to ear emergence, days to milking, days to physiological maturity, and days to physical maturity

Introduction

Forage cereals, within the cereal species of oats, wheat, barley or triticale, have the potential to be an integral part of providing year round feed in a dry land dairy system. They can provide feed to overcome autumn and winter forage shortages, allow the making of whole crop cereal silage, and provide the dual options of grazing and grain production. Cereals are highly suited to dry land farming and can tolerate a wide spectrum of soil conditions. Although 24 treatments viz. 4 date of sowing, 3 seed rate (100, 125 and 50 kg/ha) and 2 cutting management (no cut left for grain production and cut at 45 days after sowing then left for grain production) were put in randomized block design with three replications Choubay *et al* (2002) [2]. In the vegetative phase they are similar in palatability and nutritive value to ryegrass for livestock. Barley posse's higher crude protein and digestible dry matter concentrations comparing to oats at all stages of maturity. Barley forage was more digestible than was oats largely due to a higher proportion of highly digestible inflorescence in the total dry matter of barley at all stages. Spring wheat also contained more crude protein than did oats. Wheat and oats had similar digestibility. Several barley cultivars are available as feed (grain for animal feeding) and as forage varieties, and can be sown later than oats, wheat and triticale. The highest plant population, plant height and effective tillers at harvest, spike length, highest number of spikelet/spike. While, 1000 grain weight did not influence significantly due to date of sowing and seed rate, however, cutting management significantly influenced 1000 grain weight and heaviest 1000 grain weight was recorded under no cut treatment. Choubay, S. K., *et al* (2011) [3]. During the log phase of growth the cuttings of crops for forage results in hampering the growth of the plants. The investigations to ascertain the extent to which the damage may occur or otherwise the damage may be repairable are needed to justify the utility of crops as fodder as well as grain without affecting the productivity. The role of morpho-physiological traits is also required to be investigated. Keeping in view the above facts the present investigation was under taken to study the physiological efficiency and productivity in Wheat, Barley and Oat crops under various cutting management practices. The First fodder cut was taken at 45, 60 and 75 days after sowing for first, second and third cutting management Sharma, N., (2007) [7].

Methods and materials

The present investigations were carried out at the experimental field of All India Co-ordinated Research Project on forage crops, Live Stock Farm, Department of Agronomy, College of Agriculture, JNKVV, Jabalpur (M.P). This work was carried out in Rabi of 2011-12 and 12-13 in a split plot design (SPD) replicated thrice. The experimental material consisted of 3 cereal crops viz.; wheat (VL829),Oat (RD2552), Barley (JO1) as main plot treatments and 4 cutting dates i.e. no cutting, single cutting at 50 days after sowing (DAS),single cutting 60 (DAS) and single cutting at 70 (DAS) respectively as sub plot treatment. Parameters contributing the morphoframe of the crops were recorded periodically.

Phonological events of the crop (Days to leaf appearance, Days to tiller initiation, Days to full stem elongation, Days to leaf senescence, Days to booting, Days to ear emergence, Days to milking, Days to physiological maturity, Days to physical maturity) in both the year. For growth analysis, plants from 1-m row per plot were cut at the soil surface level and dried at 70 °C to constant weight to determine total dry matter (TDM) accumulation. Initial. Leaf area index was determined at the full heading stage. At physiological maturity, plants from a 1-m row area were cut at the ground level, counted for the seed bearing heads, and then oven-dried to constant weight for the determinations of grain dry matter and above-ground biomass. Harvest index was then calculated as the grain dry matter over the total above-ground biomass. At maturity, central rows of each plot were combine harvested to estimate the grain yield in 2012 and 2013, grain yield of all plots was determined by hand harvesting an area of six rows by 2 m in length. Fischer's method of analysis of variance was applied for the analysis of the data and Interpretation of results as suggested by Panse and Sukhatme (1967). The level of significance used in F and t test was P=0.05. Critical difference (CD) values were calculated at 5 per cent probability level, wherever F test was significant.

Table 1 (A): Various phenophases in treatments and their interactions

Main treatments	Days to ear emergence	Days to milking	Days to physiological maturity	Days to physical maturity
W	78.17	87.75	104.25	115.75
O	91.58	103.67	92.92	119.25
B	68.17	78.33	113.17	102.00
Sem ±	0.11	0.06	0.27	0.08
C.D.5%	0.44	0.23	0.76	0.33
Sub treatments				
C_1	79.67	89.67	103.44	112.44
C_2	79.44	90.00	103.00	112.11
C_3	78.89	89.56	103.56	112.33
C_4	79.22	90.44	103.78	112.44
Sem ±	0.18	0.18	1.57	0.20
C.D.5%	0.52	0.52	-	-
Interactions				
WC_1	79.00	88.00	104.33	116.00
WC_2	78.67	88.00	105.00	115.33
WC_3	77.00	87.00	103.33	116.00
WC_4	78.00	88.00	104.33	115.67
OC_1	91.00	103.00	92.67	120.00
OC_2	92.00	104.00	91.33	119.00
OC_3	91.67	103.33	93.33	119.00
OC_4	91.67	104.33	94.33	119.00
BC_1	69.00	78.00	113.33	101.33
BC_2	67.67	78.00	112.67	102.00
BC_3	68.00	78.33	114.00	102.00
BC_4	68.00	79.00	112.67	102.67
Sem ±	0.15	0.15	1.36	0.17
C.D.5%	0.44	0.44	-	0.51

Table 1 (B): Various phenophases in treatments and their interactions

Main treatments	Days to ear emergence	Days to milking	Days to physiological maturity	Days to physical maturity
W	77.83	87.33	104.42	115.83
O	67.92	78.00	93.50	101.75
B	91.67	103.67	112.75	119.33
Sem ±	0.11	0.31	0.83	0.26
C.D.5%	0.30	0.87	2.31	0.72
Sub treatments				
C_1	79.33	89.78	103.44	112.44
C_2	79.56	89.44	103.22	112.33
C_3	78.56	89.33	103.56	111.89
C_4	79.11	90.11	104.00	112.56
Sem ±	0.85	0.82	1.10	1.06
C.D.5%	-	-	-	-
Interactions				
WC_1	78.33	87.67	103.67	115.67
WC_2	78.67	87.33	105.00	116.00
WC_3	76.67	86.67	103.00	115.67
WC_4	77.67	87.67	106.00	116.00
OC_1	68.33	78.00	94.00	101.67
OC_2	68.00	77.67	92.33	101.67
OC_3	67.33	77.67	94.67	101.33
OC_4	68.00	78.67	93.00	102.33
BC_1	91.33	103.67	112.67	120.00
BC_2	92.00	103.33	112.33	119.33
BC_3	91.67	103.67	113.00	118.67
BC_4	91.67	104.00	113.00	119.33
Sem ±	0.74	0.71	0.95	0.92
C.D.5%	-	-	-	-

Table 1 (C): Various phenophases in treatments and their interactions.

Main treatments	Days to ear emergence	Days to milking	Days to physiological maturity	Days to physical maturity
W	78.00	87.54	104.33	115.79
O	79.75	90.83	93.21	110.50
B	79.92	91.00	112.96	110.67
Sem ±	0.11	0.19	0.55	0.17
C.D.5%	0.37	0.55	1.53	0.52
Sub treatments				
C_1	79.50	89.72	103.44	112.44
C_2	79.50	89.72	103.11	112.22
C_3	78.72	89.44	103.56	112.11
C_4	79.17	90.28	103.89	112.50
Sem ±	0.51	0.50	1.34	0.63
C.D.5%	0.52	0.52		
Interactions				
WC_1	78.67	87.83	104.00	115.83
WC_2	78.67	87.67	105.00	115.67
WC_3	76.83	86.83	103.17	115.83
WC_4	77.83	87.83	105.17	115.83
OC_1	79.67	90.50	93.33	110.83
OC_2	80.00	90.83	91.83	110.33
OC_3	79.50	90.50	94.00	110.17
OC_4	79.83	91.50	93.67	110.67
BC_1	80.17	90.83	113.00	110.67
BC_2	79.83	90.67	112.50	110.67
BC_3	79.83	91.00	113.50	110.33
BC_4	79.83	91.50	112.83	111.00
Sem ±	0.44	0.43	1.16	0.55
C.D.5%	0.44	0.44		0.51

Results and Discussion

Days to ear emergence

The data in respect of days to ear emergence showed exhibited in that crop Barley (79.92 days) and Wheat (78.00 days) required significant maximum and minimum to reach this stage.

The study of this character in sub treatments indicated that C_1 (79.50 days) maximum and C_3 significant minimum (78.72 days) time to attain this stage.

In interactions, BC_1 (80.17), OC_2 (80.00 days) and BC_2 (79.83 days) required significant more time to exhibit this stage. WC_3 had the minimum time (76.83 days) to reach this stage.

Days to milking

The study pertaining to days to milking stage indicated that crop Wheat (87.54 days) and Barley (91.00 days) took significant minimum and maximum time to record this stage.

The study of sub treatments for this stage indicated that C_4 took maximum time (90.28days) and C_3 minimum (89.44 days) period to acquire this stage. However, C_2 was at par with C_3 (89.72 days).

In interactions OC_4 (91.50 days), BC_4 (91.50) and BC_3 (91.00 days) required significant more time to achieve this stage. On the other hand WC_3 (86.83) and WC_2 (87.67days)) took the minimum time to attain this stage.

Days to physiological maturity

Among main treatments crop oat (93.21 days) required significant minimum and Barley maximum time (112.96) to reach physiological maturity stage.

The study of same trait in sub treatments and inter actions indicated that C_4 (103.89 days) and C_3 (103.56 days) in sub treatments and BC_3 (113.50 days), BC_1 (92.33 days) in interactions required maximum and minimum time, respectively to reach this stage.

Days to physical maturity

The study of this trait in main treatments showed that crop Oat (110.50 days) and Wheat (115.79 days) required significant minimum and maximum days to attain physical maturity.

Sub treatments C_4 (112.50 days) and C_3 (112.11 days) were associated with maximum and minimum time to attain this stage in sub treatments.

In interactions WC_1 (115.83 days) took significant more time to reach this stage. On the other hand OC_2 (110.17 days) indicated the significant minimum time to acquire this stage.

Conclusion

The results revealed that the phenological traits indicated variable response. Among main treatments Oat crop required the minimum time to attain physiological maturity (93.21 days) and field maturity (110.50 days), however, Wheat required the minimum time to attain ear emergence (78.0 days) and milking stage (87.54 days).Barley recorded the highest (44.09 days) duration of reproductive phase, followed by Oat (44.05 days) and Wheat (42.75 days), respectively.

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