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RESEARCH ARTICLE :

Study of treatments and their interaction throughout poximate analysis in Wheat, Oat and Barley crops

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SUMMARY : An experiment was conducted in *Rabi* season during 2012-2013 to find out the effect of cereal crops (Wheat, Oat, Barley) and cutting schedule on forage and grain yield. The study revealed the maximum chlorophyll accumulation in Barley and wheat during initial stage at 95 DAS and wheat and barley during reproductive stage at 30 DAS. Cutting at 50 DAS is proved beneficial on chlorophyll accumulation. Photosynthetic rate were maximum in wheat at 90 DAS. However, cutting did not affect photosynthesis rate stomatal conductance and transpiration rate. Barley gave maximum fodder yield (fresh/day). Cutting at 50 DAS was beneficial in producing maximum fodder yield without sacrificing grain yield of cereal crops.

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KEY WORDS :
Wheat, Oat, Barley, Protien, Cabohydrate, Fibre

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BACKGROUND AND OBJECTIVES

Wheat (*Triticum aestivum*), Oat (*Avena sativa* L.) and Barley (*Hordeum vulgare* L.) are the cereal crops of the world in general and India in particular. India ranks second in wheat, fifth in oat, fourth in barley. Wheat is the most important staple food grain in India (70 million tons per year).Owing to vareatizle ecological adaptability barley is the second largest producing crop cereal crop of winter season in India. Oat is mainly used as fodder crop in the world with legume fodder as compared to food grain crop. In the recent years, it has been observed that because of severe drought in the drier of northern plains (Rajasthan, Southern Haryana, Western U.P. and Madhya Pradesh), there is an acute shortage of green fodder in the months of November to January. Barley can be utilized as a source of green fodder under such situations. The crop can be given one cut at definite time after sowing for green fodder and regeneration crop may be utilized for grain purpose. Oats (*Avena sativa* L.) rank fifth in terms of world production of cereals. They are also widely used as a companion crop for under-seeding of forage legumes The average green yield of local cultivars (tall with very narrow leaves and thin stems, hence, not responsive to nitrogenous fertilizers due to lodging) under rain fed conditions is 20 tons/ha, which is very low and insufficient to provide even maintenance rations for the

numbers of live stock kept. In winter farmers have only dried summer grass or dry stalks of summer cereals to supplement the small amount of forage grown and have to purchase costly fodder transported in large quantities from distant irrigated tracts. In contrast to local landraces, improved oats grow very fast, can be cut earlier and have considerable potential to provide feed during deficit periods and low temperatures. Generally, farmers harvest these fodders at 50 per cent flowering, or at a later stage to get maximum green yield with a consequent loss in quality. The productivity of a crop stand depends on its capacity of photosynthesis, photosynthetic area and the utilization of photosynthetic active radiation within the crop canopy. In graminaceous crops, the grain yield is a product of grain weight per ear and number of ear per unit area. Chlorophyll is vital for photosynthesis, which allows plants to absorb energy from light. Chlorophyll content is an index of organic matter production and plant growth. The increased photosynthesis has been linked to increased chlorophyll content in plants. As a result, chlorophyll content is a measurement of physiological activities in plants. *Abiotic* stress is a major factor around the world in limiting plant growth and productivity. Exposure of plants to a stressful environment during various developmental stages appears to induce various physiological and developmental changes. Indian dairy industry is facing a lot of shortage of green forage during winter and summer seasons especially in terms of cereal forage. Hence the present experiment was conducted to find out suitable cereal crop for *Rabi* season by cutting existing crop once and then crop grown for food grain production without reducing food grain productivity. Physiological traits like chlorophyll index, photosynthetic rate, stomatal conductance and transpiration rate were used as parameters to judge the suitability of cereal crops for fodder and grain production with reference to central India.

RESOURCES AND METHODS

The present investigation was 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.) during the *Rabi* season 2012-13 in a Spilt Plot Design (SPD), replicated thrice .The experimental material consisted of 3 cereal crops *viz.;* (VL829), Oat (RD2552), Barley (JO1) as main plot treatments and 4 cutting dates *i.e.* no cutting wheat, single cutting at 50 days after sowing (DAS), single cutting 60 (DAS) and single cutting at 70 (DAS) respectively as sub plot treatment. Physiological traits studied were chlorophyll index (at 30 DAS), photosynthetic rate, stomatal conductance and transpiration rate at 50 DAS. The chlorophyll index was estimated using chlorophyll meter (model-CCM200). Other physiological traits like photosynthetic rate, stomatal conductance and transporate rate were recorded at 50 DAS using IRGA (Infrared Gas Analyzer) based equipment (make Li-Cor, USA, model Li-Cor-6400) as per method suggested by Kannan *et al.* (2007).

OBSERVATIONS AND ANALYSIS

The investigations revealed significant differences among treatments and their interactions throughout proximate analysis during 2012-2013.

The protein content (%) in Barley crop (16.65) significantly dominated over other crops for protein content and Oat registered the lowest (9.64). Among sub treatments, C_1 (13.38) superseded other sub treatments for the same traits. The lowest magnitude was noted in C_3 (13.17). In interactions, OC_3 (16.77) and OC_4 (16.77) registered significant more protein content over rest of the interactions. The lowest value (9.57) was found in BC_4. About carbohydrate content in oat crop (73.43) significant dominated over other crops for carbohydrate content barley registered the lowest (62.90) magnitude. Among sub treatment, C_2 (71.28) significant superseded other sub treatment for the same character. C- $\frac{1}{1}$ had the lowest (66.77) value for this trite. In interaction, BC_2 (77.50) at par with BC_4 (77.43) had significant more carbohydrate content over rest of the interaction. The lowest value (59.27) was recorded in OC_1.The result showed about fibre content in barley crop (14.95) significant dominated other crops for fibre content. Wheat registered the lowest (10.03) magnitude for this trait. Among sub treatment, C_3 (11.996) superseded other sub treatments for the same trait. The lowest value was recorded in C_4 (11.31).Treatment combination BC-$_3$ (15.23) andBC_1 (15.03) registered significant more fibre content over rest of the interaction. The lowest was recorded in WC-$_2$ (9.37).

Proximate analysis in year 2013-2014 the result showed that the proximate analysis exhibited significant difference among main treatments at protein%,

carbohydrates% and fiber% sub treatments and interaction during protein% and carbohydrates%. The result showed that protein content in barely (16.63) significantly dominated over other crop for protein content oat registered the lowest (9.60).Among sub treatment C-$_1$ (13.40) superseded other sub treatment for the same trait. The lowest value (13.09) was found in C_3.In interaction, BC_3 (16.77) and BC_4 (16.67) registered significant more protein content over rest of the interaction. The lowest value (9.53) was recorded in OC_4 and oat crop (72.93) significant dominated over other crops for carbohydrate content. Barely registered the lowest (63.19) magnitude. Among sub treatment, C_2 (70.86) significant superseded other sub treatment for carbohydrate content. C_1 had the lowest (66.30) carbohydrate. In interaction, OC_2 (77.37) par with OC_4(77.37) had significant more carbohydrate content over rest of the interactions. The lowest value (59.23) was recorded the lowest (9.47) magnitude. The result showed (Table 4.12(B), Figure 13) that. Oat crop (15.08) significantly dominated others crops for fibre content. Wheat registered the lowest (9.47) magnitude. The result indicated that among sub treatment and interaction C_1 that among sub treatment and interaction C_1 (12.01) and C_3 (10.87) in sub treatment and OC_1 (15.50) andWC_3 (7.44) in interactions recorded the maximum and minimum magnitude for this trait, respectively.

The investigation revealed that significant difference among treatments and their interactions their interactions throughout proximate analysis during pooled analysis the result showed that wheat (13.46) significant dominated over other crops for protein content registered the lowest (13.13) magnitude. Among sub treatment, C_1 (13.39) superseded other s8ub treatment for the protein content. The lowest value (13.13) was found in C_3. In interaction, WC_1 (14.03) had significant more protein content over

Table 1: Proximate analysis in treatments and interactions at successive life span

Main treatments	Protien (%)	Carbohydrate (%)	Fibre (%)
W	13.46	69.67	9.76
O	13.13	67.92	12.57
B	13.14	68.31	12.51
S.E. ±	0.09	0.25	0.39
C.D. (P=0.05)	0.29	0.79	1.18
Sub treatments			
C_1	13.39	66.53	11.87
C_2	13.24	71.07	11.77
C_3	13.13	68.52	11.43
C_4	13.21	68.41	11.39
S.E. ±	0.11	0.49	0.73
C.D. (P=0.05)	0.25	1.11	0.54
Interactions			
WC_1	14.03	71.67	10.47
WC_2	13.38	69.33	10.03
WC_3	13.07	70.00	9.06
WC_4	13.37	67.67	9.48
OC_1	13.03	63.63	12.68
OC_2	13.17	72.02	12.63
OC_3	13.15	67.57	12.63
OC_4	13.15	68.45	12.33
BC_1	13.10	64.30	12.45
BC_2	13.17	71.85	12.63
BC_3	13.17	67.98	12.60
BC_4	13.12	69.10	12.35
S.E. ±	0.09	0.42	0.63
C.D. (P=0.05)	0.21	0.94	0.46

rest of the interaction. Through WC_2 (13.38) lagged behind the former but showed significant superiority over rest of the interaction expect WC_4, OC_2, BC_2- and BC_3 which exhibited non significant difference with the former. The lowest value (13.03) was found in OC_1 and Carbohydrate content that wheat 69.66 significant dominated over other for carbohydrate content oat registered the lowest (67.91). Among sub treatments C_2 (71.06) significant superseded other sub treatment for carbohydrate content C_1 had the lowest (66.53) carbohydrate. In interaction, OC_2 (72.01) and BC_2 (71.85) registered significant more carbohydrate content over rest of the value (63.63) was found in OC_1. And study showed that the fibre content in oat (12.57) possessed the higher fibre over rest of main treatment. Wheat registered the significant lowest (9.56) magnitude among main treatments. Among sub treatment C_1 (11.87) supersede other sub treatment for fibre content. The lowest value (11.39) was found in C_4.In interaction, OC_1 (12.68) had significant more fibre content over rest of the interactions. Though OC_2 (12.63) lagged behind the former but showed signification superiority over rest of the interactions except OC_3 (12.63) and BC_2 (12.63). The lowest value (9.06) was recorded in WC_3.

The result showed that barley crop (16.65) significant dominated over other crops for protein content. Oat resisted the lowest (9.64). Among sub treatment, C_1 (13.38) superseded other sub treatment for the same trait. The lowest magnitude was noted in C_3 (13.17) protein content in year 2012-2013**.** In interaction, OC_3 (16.77) and OC_4 (16.77) registered significant moiré protein content over rest of interaction. The lowest value (9.57) was found in BC_{4-}.

Conclusion :

The proximate analysis indicated that among main treatments Wheat recorded the maximum protein (13.46%) and carbohydrate (69.66%) contents, whereas Oat recorded the maximum fibre content (12.57%), respectively. In sub treatments C_1 had the maximum protein (13.39%) and fibre contents (11.87%), whereas C_2 (71.06%) recorded the maximum carbohydrate content, respectively. In interactions WC_1 (14.03%) and WC_2 (13.38%) had the maximum protein content, OC_1 (12.68%) and OC_2 (12.63%)- fibre content and OC_2 (72.01%) and BC_2 (71.85%) - carbohydrate contents respectively.

In benefit cost ratio among main treatments Wheat recorded the maximum (3.24) B:C ratio, followed by Oat (2.53). In sub treatments C_2 recorded the maximum B.C. ratio (2.76), whereas in interactions WC_3 recorded the maximum B.C. ratio (3.61) followed by WC_1 (3.45).

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