

Study of cutting management on proximate analysis in wheat, oat and barley crops

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Abstract

An experiment were 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 the 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.

Highlights

- Wheat recorded the maximum protein (13.46%) and carbohydrate (69.66%) contents, whereas Oat recorded the maximum fiber content (12.57%), respectively. In sub –treatments, C₁ had the maximum protein (13.39%) and fiber contents (11.87%), whereas C₂ (71.06%) recorded the maximum carbohydrate content.

Keyword: Wheat, Oat, Barley, protien, cabohydrate and fiber

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 versatile ecological adaptability barley is the second largest producing crop cereal crop of winter season in India. Oat is mainly used as the 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 a 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 regarding wordiness 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 regarding 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 concerning central India.

Materials 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 Split 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 (C1) at 50 days after sowing (DAS), single cutting (C2) 60 at DAS and single cutting at (C2) 70 at DAS respectively as sub-plot treatment.

Protein (%)

The nitrogen content in Wheat grain was estimated by modified micro jeldal method and the protein content was calculated by multiplying the nitrogen content with the factor 6.25 (Tai and Young, 1974) (AOAC, 1980).

Carbohydrate

This was determined by the method given by Sadasivam Manickam, 1992. The calculations are as follows:

Where,

Absorbance corresponds to 0.1 ml of the test X mg of glucose.

100 ml of the sample solution contains $(\times/0.1) \times 100$ mg of glucose = % of total carbohydrate present.

Fibre (%) (Sadasivam and Manickam 1992)

Materials

1. Sulphuric acid solution: 12.5 ml of conc. sulphuric acid was diluted to 1 litre distilled water.
2. Sodium hydroxide solution: 12.5 g of sodium hydroxide was dissolved in 1 liter distilled water.

Procedure

1g of defatted seed sample obtained from estimation of fat % was weighed accurately and noted (W). The weighed samples were then transferred to oven dried crucibles. The crucibles were then placed into metal adapters of the fiber plus hot extraction unit, and proper sealing of crucibles against the adapter rubber was ensured. 150 ml of 1.25% H₂SO₄ was then poured into the extractors from the top. The instrument was switched on, and the temperature was set to 40-52°C and the samples were boiled for 30 minutes in the acid. After boiling, the acid

was drained out and the samples were washed twice or thrice with distilled water. After washing, 150 ml of 1.25% NaOH was poured into the extractors. The instrument was switched on again at a temperature of 40-52°C and against boiled for another 40 minutes. When the process is over the alkali was drained out and the sample was again washed with distilled water. The crucibles were then taken out and kept in hot air oven unit the crucibles are free from moisture. The crucibles were cooled down using a desiccators and the crucibles were weighed (W_1). The crucibles were then finally placed in a muffle furnace for ashing at 550 °C. The hot crucibles were cooled after ashing and finally the crucible were weighed (W_2).

$$\text{Fibre (\%)} = \frac{W_2 - W_1}{\text{Weight of sample}} \times 100$$

Results and Discussion

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 cabohydrate 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_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 fiber content in barley crop (14.95) significant dominated other crops for fiber 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 were recorded in C_4 (11.31). Treatment combination BC_3 (15.23) and BC_1

(15.03) registered significant more fiber 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 another crops for carbohydrate content. Barely registered the lowest (63.19) magnitude. Among sub treatment, C_2 (70.86) significantlty 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 1) that Oat crop (15.08) significantly dominated others crops for fiber 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) and WC_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 ssub treatment for the protein content. The lowest value (13.13) was found in C_3 . In interaction, WC_1 (14.03) had significantly more protein content over 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

Table 1: Proximate analysis in treatments and interactions at successive life span 2012-13

Main treatments	Protien (%)	Carbohydrate (%)	Fiber (%)
Wheat	13.48	70.00	10.03
Oat	16.65	62.90	10.07
Barley	9.64	73.43	14.95
Sem ±	0.08	0.16	0.14
C.D.5%	0.32	0.63	0.55
Sub treatments			
C ₁	13.38	66.77	11.72
C ₂	13.22	71.28	11.71
C ₃	13.17	68.73	11.99
C ₄	13.27	68.32	11.31
Sem ±	0.07	0.20	0.18
C.D.5%	0.21	0.58	0.54
Interactions			
WC ₁	14.00	71.67	10.27
WC ₂	13.30	69.67	9.83
WC ₃	13.17	70.67	10.67
WC ₄	13.47	68.00	9.37
OC ₁	16.47	59.27	9.87
OC ₂	16.60	66.67	10.50
OC ₃	16.77	66.13	10.07
OC ₄	16.77	59.53	9.83
BC ₁	9.67	69.37	15.03
BC ₂	9.77	77.50	14.80
BC ₃	9.57	69.40	15.23
BC ₄	9.57	77.43	14.73
Sem ±	0.06	0.17	0.16
C.D.5%	0.18	0.50	0.46

Table 2: Proximate analysis in treatments and interactions at successive life span 2013-14

Main treatments	Protien (%)	Carbohydrate (%)	Fiber (%)
Wheat	13.44	69.33	9.49
Oat	9.60	72.93	15.08
Barley	16.63	63.19	10.07
Sem ±	0.10	0.34	0.65
C.D.5%	0.27	0.95	1.80
Sub treatments			
C ₁	13.40	66.30	12.01
C ₂	13.26	70.86	11.82
C ₃	13.09	68.30	10.87
C ₄	13.16	68.49	11.47
Sem ±	0.14	0.78	1.28
C.D.5%	0.29	1.63	–

Interactions			
WC ₁	14.07	71.67	10.67
WC ₂	13.47	69.00	10.23
WC ₃	12.97	69.33	7.44
WC ₄	13.27	67.33	9.60
OC ₁	9.60	68.00	15.50
OC ₂	9.73	77.37	14.77
OC ₃	9.53	69.00	15.20
OC ₄	9.53	77.37	14.83
BC ₁	16.53	59.23	9.87
BC ₂	16.57	66.20	10.47
BC ₃	16.77	66.57	9.97
BC ₄	16.67	60.77	9.97
Sem ±	0.12	0.67	1.11
C.D.5%	0.25	1.39	NS

the former. The lowest value (13.03) was found in OC₁ and carbohydrate content that wheat 69.66 significant dominated over other for carbohydrate content oat registered the lowest (67.91). Among sub -treatments C₂ (71.06) significant superseded other sub -treatment for carbohydrate content C₁ had the lowest (66.53) carbohydrate. In interaction, OC₂ (72.01) and BC₂ (71.85) registered significant more carbohydrate content over rest of the value (63.63) was found in OC₁. And the study showed that the fiber content in oat (12.57) possessed the higher fiber over rest of main treatment. Wheat registered the significant lowest (9.56) magnitude among main treatments. Among sub treatment C₁ (11.87) supersede other sub treatment for fiber content. The lowest value (11.39) was found in C₄. In interaction, OC₁ (12.68) had significant more fiber content over rest of the interactions. Though OC₂ (12.63) lagged behind the former but showed signification superiority over rest of the interactions except OC₃ (12.63) and BC₂ (12.63). The lowest value (9.06) was recorded in WC₃.

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, C₁ (13.38) superseded other sub treatment for the same trait. The lowest magnitude was noted in C₃ (13.17) protein content in the year 2012-2013. In interaction, OC₃ (16.77) and OC₄ (16.77) registered significant moiré protein content over rest of interaction. The lowest value (9.57) was found in BC₄.

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 fiber content (12.57%), respectively. In sub-treatments, C₁ had the maximum protein (13.39%) and fiber contents (11.87%), whereas C₂ (71.06%) recorded the maximum carbohydrate content, respectively. In interactions WC₁ (14.03%) and WC₂ (13.38%) had the maximum protein content, OC₁ (12.68%) and OC₂ (12.63%)- fiber content and OC₂ (72.01%) and BC₂ (71.85%) - carbohydrate contents, respectively.

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