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Quality Response of Oats *Avena sativa* L. to Integrated Weed Management

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Abstract

The research under the title of effects of integrated weed management on the nutritional quality of Oats (*Avena sativa* L.) had been conducted in the research farm of Lovely Professional University during the season of winter 2019-2020 to assure the effects of integrated weed management on the quality parameters of Oats (protein content and fibre content).

The experimental design for this research work was Randomized Block Design (RBD) which was contained of nine treatments replicated three times. Different weed control methods were applied in the treatments like; weedy check (control), weed free check, hand weeding at 25 days after sowing, hand hoeing at 25 days after sowing, pre-emergence application of Pendimethalin@0.75 kg a.i. ha^{-1}+one hand weeding at 40 days after sowing, post emergence application of 2-4-D@0.75 kg a.i. ha^{-1} at 21 days after sowing+one hand weeding at 35 days after sowing, post emergence metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 days after sowing+one hand weeding at 35 days after sowing, post emergence application of 2-4-D@0.75 kg a.i. ha^{-1} at 21 days after sowing+one hand hoeing at 35 days after sowing and post emergence metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 days after sowing +hand hoeing at 35 days after sowing. The variety of oats which had been used for conducting the research was Kent and its sown by drilling method in the rows with the specific spacing of 25 cm and depth of 1cm-2 cm on a flatbed with the plot size of 5 m × 3 m.

According to the content of crude fiber and crude protein content there was no significant variation but crude protein and crude fibre yield was significantly affected by various treatments. The highest yield in case of crude protein and crude fibre were recorded in weedy free check while it was almost the same with Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand weeding at 35 DAS which recorded in terms of crude protein and crude fibre yield.

Keywords: Crude fibre content; Crude protein content; Crude fibre yield; Crude protein yield

Introduction

Oats (*Avena sativa* L.) is a crop which has a very long history of sowing in the west European countries. Major oat producing countries are USA, ex-USSR, Canada, Poland, France, Germany and the UK. Approximately 30 million hectares area is covered by this crop all over the world. Oats are grown in the northern, western and central India as a winter crop. Presently cultivated on a large scale in Punjab, Haryana, and Uttar Pradesh and to a limited extent in certain parts of Himachal Pradesh, Maharashtra, Gujrat, Madhya Pradesh, Orissa, Bihar, and West Bengal (Chandy 2002).

Because of quick growing savory and nutritious for the livestock Oat is the major cereal forage crop of Rabi season in India. In case of dry matter digestibility the nutritional value of forage oat is more than 75 percent if fed to dairy cattle.Other cereals which have same chemical composition like oats are not that much rich in term of digestibility organic matter as oats is.spring oats straw is rich as compare to winter oats In case of metabolic energy, but by considering available energy both types are better than other cereals.Compare to the other cereals the straw of oats is softer, savory and much more acceptable for livestock feeding.

Being a Rabi irrigated and long durational crop, the oat is massively infested with various species of annual and perennial weeds, some of those are not preferred by animals e.g. Kharbathua (*Chenopodium murale*), Carrot grass (*parthenium hysterophorous*), Hariyali (*cynodon dactylon*)And wild hollyhock (*althaea ludwigri*).

Based on above facts, following inquiry was suggested for the following purposes;

To assess the effect of integrated weed management on growth, yield and quality of oat.

To study the efficacy of herbicides in controlling weeds in oat.

To study the economics of integrated weed management in oat.

To assure the most effective method for weed control in Oat.

Materials and Methods

This research project had been conducted in the research farm of LPU Lovely Professional University Jalandhar-Punjab India at Rabi season of 2019-20 which was under the title of (Effects of integrated weed management on nutritional quality of oats *Avena sativa* L.).

The materials and methodology of the research had been explained in this chapter.

Experimental design and Details

Crop and variety: Oat (*Avena sativa* L.) Kent

Working season: Rabi November 2019-20

Date of sowing: 15/Nov/2019

Method of sowing: Line sowing

Seed Rate: 100 kg ha^{-1}

Spacing: 25 cm

Total area: 450 m^2

Total number of plots: 27

Per plot size: 15 m^2

Design: Randomized Block Design (RBD)

Number of treatments: 9

Number of replications: 3

Recommended Dose of fertilizer: 75:20:0 (N: P2O5:K2O) kg ha^{-1}

Symbol	Treatment Details
T1	Weedy check (Control).
T2	Weed free check.
T3	Hand weeding at 21 DAS.
T5	Pre-emergence application of pendimethalin@0.75 kg a.i. ha^{-1}+one Hand weeding at 35 DAS.
T6	Post emergence application of Atrazine@0.75 kg a.i. ha^{-1} at 21 DAS+One hand weeding at 35 DAS.
T7	Post emergence application of metsulfuron methyl @ 0.004 kg a.i. ha^{-1} at 21 DAS+one hand weeding at 35 DAS.
T8	Post emergence application of Atrazine@0.75 kg a.i. ha^{-1} at 21 DAS+One hand hoeing at 35 DAS.
T9	Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand hoeing at 35 DAS.

Table 1: Details of treatments.

R1T1	**Irrigation channel**	R2T5	R3T3	**Irrigation channel**
R1T2		R2T7	R3T6	
R1T3		R2T1	R3T2	
R1T4		R2T9	R3T8	
R1T5		R2T2	R3T4	
R1T6		R2T8	R3T9	
R1T7		R2T3	R3T1	
R1T8		R2T6	R3T7	
R1T9		R2T4	R3T5	

Table 2: Field layout.

Crude protein content

Crude protein content was measured by multiplying of percent of the nitrogen by a factor of 6.25 (A.O.A.C., 2005).

Crude protein yield

The estimation of the crude protein yield was done by the use of following formula;

$$CPY\ q\ ha-1 = \frac{CPC\ \%\ x\ \ DM\ yield\ (q\ ha-1)}{100}$$

Where; CPY: Crude Protein Yield, CPC : Crude Protein Content, DM: Dry Matter

Crude fiber content

The determination of the crude fiber content in forage had been done by using of the following formula;

Given by (A.O.A.C 2005).

$$Crude\ fiber\ content\ \% = \frac{wt.of\ dried\ residue\ (g) - wt.of\ \ ash\ (g)}{wt.of\ dried\ sample\ (g)} x100$$

Crude fiber yield

The crude fiber yield had been calculated by the use of following formula;

$$CFY\ q\ ha-1 = \frac{crude\ fiber\ content\ \%\ \ x\ \ DM\ yield\ (q\ ha-1)}{100}$$

Where; CFY: Crude Fiber Yield, DM: Dry Matter

Crude Protein and Crude Fiber Content

Data regarding crude protein and crude fiber content as influenced by different treatments is shown in Table 3.

By the observing of the table 3 we can see that there is no significant difference in crude protein and crude fiber content among all the treatments this might be due to the genetic characteristics of the variety hence we used only one variety so that different weed control treatments could not affect crude protein and crude fiber contents. Almost same results were also stated by Naik et al.

Treatments	CP Content %	CF Content %	CP Yield qha-1	CF Yield qha-1
Weedy check (Control).	7.123	34.507	3.231	15.652
Weed free check.	7.183	34.437	6.988	33.5
Hand weeding at 21 DAS.	7.063	34.77	5.216	25.674
Hand hoeing at 21 DAS.	6.9	34.517	4.23	21.159
Pre-emergence application of pendimethalin@0.75 kg a.i. ha-1+ one Hand weeding at 35 DAS.	7.227	34.71	6.293	30.227
Post emergence application of Atrazine@0.75 kg a.i. ha-1 at 21 DAS+One hand weeding at 35 DAS.	7.133	35	4.763	23.371
Post emergence application of metsulfuron methyl@0.004 kg a.i. ha-1 at 21 DAS+one hand weeding at 35 DAS.	7.2	34.567	6.644	31.899
Post emergence application of Atrazin	7.123	34.903	4.545	22.271

@0.75 kg a.i. ha-1 at 21 DAS+One hand hoeing at 35 DAS.				
Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand hoeing at 35 DAS.	7.223	35.007	5.884	28.514
S.E.m.±	0.003	0.011	0.003	0.011
C.D (P=0.05)	NS	NS	0.009	0.034
General Mean	7.13	34.713	5.31	25.807

Table 3: Crude protein and crude fibre content (%) and yield (qha-1) of oat as influenced by different treatments.

Crude protein and Crude fiber Yield

The data regarding crude protein and crude fibre yield as influenced by various treatments.

Crude protein and crude fibre yield was significantly affected by various treatments. The highest yield in case of crude protein and crude fibre (6.988 qha^{-1} and 33.500 qha^{-1}) were recorded in weedy free check while it was almost the same with Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand weeding at 35 DAS which recorded (6.644 qha^{-1} and 31.899 qha^{-1}) in terms of crude protein and crude fiber yield.

The lowest crude protein yield (3.231 qha^{-1}) and crude fibre yield (15.652 qha^{-1}) were investigated in weedy check (control) treatment which was followed by the treatment of Hand hoeing at 21 DAS (4.230 qha^{-1} crude protein and 21.159 qha^{-1} crude fibre yield).

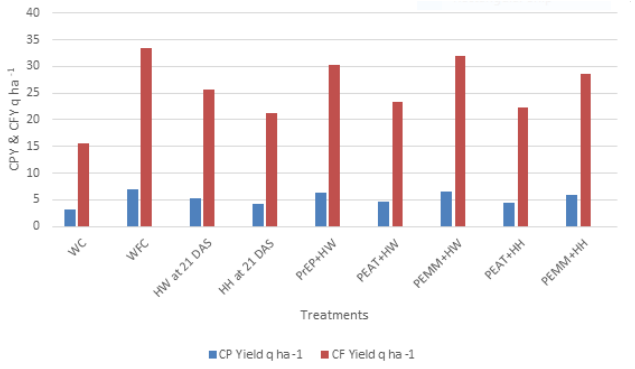

Figure 1: Crude protein and crude fibre yield (qha^{-1}) as influenced by different weed control treatments.

Statistical analysis and interpretation of data

The data recorded were statistically analyzed by using technique of analysis of variance and significance was determined as given by Panase and Sukhatme for randomized block design. Standard Error of the means (SEm ±) was worked out. Wherever the results were significant, the Critical Difference (CD) at 5% significance level was also worked out and presented. Graphical illustrations of data have been given at appropriate places.

Conclusion

Weeds are included in major pests of the crop which decreases the crop yield by a high percentage. Oat yield might decrease with a big percentage whenever weeds are competing with the crop for light, water, space and nutrients. There are many herbicides and chemicals to control weeds but they should be used as an additional tools not as main treatment. When one control method chemical or mechanical is used for a while it may causes weed resistance against that method. The following conclusions were achieved from the investigation.

According to crude protein content there was no significant difference among all the treatments and all were at a par.

But according to crude protein yield the following data was collected:

The highest crude protein content were recorded in weedy free check which was 6.988 qha-1 and after that Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand weeding at 35 DAS had the highest crude protein yield (6.644 qha^{-1}) which was followed by Pre-emergence application of pendimethalin@0.75 kg a.i. ha^{-1}+one Hand weeding at 35 DAS (6.293 qha^{-1}) and the other treatments were as follow;

Post emergence application of metsulfuron methyl@0.004 kg a.i. ha^{-1} at 21 DAS+one hand hoeing at 35 DAS (5.884 qha^{-1}), Hand weeding at 21 DAS (5.216 qha^{-1}) and after the weedy check (control) treatment (3.231 qha^{-1}) the lowest amount of crude protein yield was recorded in Hand hoeing at 21 DAS (4.230 qha^{-1}) which was followed by Post emergence application of Atrazine@0.75 kg a.i. ha^{-1} at 21 DAS+One hand hoeing at 35 DAS (4.545 qha^{-1}) which was at par with Post emergence application of Atrazine@0.75 kg a.i. ha^{-1} at 21 DAS +One hand weeding at 35 DAS (4.763 qha^{-1}).

In case of crude fibre content it was same as crude protein content and there was no significant difference and all the treatments were almost the same but according to crude fibre yield significant difference was available and the highest crude fibre yield was recorded in Weed free check (33.500 qha^{-1}) and it was followed by Post emergence application of metsulfuron methyl @ 0.004 kg a.i. ha^{-1} at 21 DAS+one hand weeding at 35 DAS (31.899 qha^{-1}) which almost equal with Pre-emergence application of pendimethalin@0.75 kg a.i. ha^{-1}+one Hand weeding at 35 DAS (30.227 qha^{-1}) and the other treatments were lower than this.

After the weedy check (control) treatment (15.652 qha^{-1}) the lowest crude fibre yield was recorded in Hand hoeing at 21 DAS (21.159 qha^{-1}).

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