



To study the economics of forage yield of promising varieties of oat (*Avena sativa* L.)

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Abstract

The present investigation entitled “To study the economics of forage yield of promising varieties of oat (*Avena sativa* L.)” was carried out at the Instructional farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur, (C.G.) during *Kharif* season. The soil of experimental field was sandy loam in texture, locally known as “*matasi soil*”. The experiment was laid out in factorial randomized block design with three replication. The treatments were allotted to different plots by using random method. Different varieties of oat (*Avena sativa* L.) viz. UPO-2005-1(V₁), NDO-1(V₂), Kent (SC) (V₃) and OS-6 (SC) (V₄) and four levels of nitrogen viz. 0 kg ha⁻¹ (N₁), 40 kg ha⁻¹ (N₂), 80 kg ha⁻¹ (N₃) and 120 kg ha⁻¹ (N₄) are two factors were kept under different treatment combinations.

Maximum net profit (Rs 11405.50 ha⁻¹) and B: C ratio (Rs 1.21 Rp⁻¹ invested) was obtained in V₁N₄ (UPO-2005-1 + Nitrogen @ 120 kg ha⁻¹) treatment combination followed by V₁N₃ (UPO-2005-1 + Nitrogen @ 80 kg ha⁻¹) (Rs 11308.00 ha⁻¹) and B:C ratio (Rs 1.25), respectively, while it was found lowest under V₂N₁ (NDO-1+ Nitrogen @ 0 kg ha⁻¹) treatment combination. Among different varieties of oat, UPO-2005-1 fetched maximum net profit (Rs. 11405.50 ha⁻¹) and B:C ratio (1.21) while NDO-1 variety could bring lowest in net profit and B:C ratio.

Keywords: *Avena sativa* L, treatment combination, *matasi soil*

Introduction

Agriculture and Animal husbandry is complementary enterprises and it plays a vital role in Indian economy. It accounts for about 56 percent of the world's buffalo population and 14 percent of the cattle population. It ranks first in respect of buffalo and second in respect of cattle population, second in goat population and third in respect of sheep in the world. Animal husbandry output constitutes about 30 percent of the country's agriculture output (Anonymous, 2007) [2].

At present, the productivity of existing stock of cattle and buffaloes is very poor which can be increased if they are fed with balance and adequate quantity of quality fodder and feeds (Singh and Yadav, 2000) [6].

This fact is adequately supported that the total potential availability of feed resources for the year 2005, work out to 45.63 million tonnes of concentrate, 495 million tonnes of green fodder.

Chhattisgarh state is rich in livestock resources having the total population of cattle, buffalo, sheep and goat is 8154673, 1887194, 206484 and 2125317 respectively. The total pasture area is about 855300 ha and forage & fodder area is about 306 ha (Anonymous, 2006) [1]. But the production is only thousand metric tonnes with per capita availability of 72.06 ml, which is very low than the recommended quantity (220 g) by Indian Council of Medical Research. The productivity of animal in Chhattisgarh is quit low in comparison to other states of the country. It has been observed that improvement of genetic make up of animal could only contributes up to 30 per cent to production and rest 70 per cent is depends on environment like proper nutrition, management and health cover (Singh and Singh, 2002) [5]. The unavailability of sufficient quantity of green fodder through the year in the state is the major constrain in the development of animal

husbandry. The major part of livestock forage resources in Chhattisgarh is met either from byproduct (wheat, rice straw /crop residues) or from the less nutritious grasses leading to low production and productivity of live stock feeding of livestock with roughs increases the farmer makes it less feasible.

In order to make animal husbandry sector more viable and productive sector, there is a great need to maintain balanced feed and fodder supply in the state. The major depends on agricultural by-product to feed the animal is detrimental to the growth of both livestock and crop sector in the state. Once the fodder supply is streamlined with more nutritious feed and fodder by stall-feeding and more productive milch herd can be sustained which in turn would accelerate the growth of milk production in the state. At present, requirements of fodder are not fulfilled. Majority of the animals are reared under sub-optimal conditions because of shrinkage in grazing land, poor management of wasteland and grazing pressure per unit land. Availability of nutritious feeds and fodders through proper scientific methods is essential for the improvement of the vast livestock resource. Therefore, there is a need to boost the production of green and dry fodder yield. Among the fodder crops, oat (*Avena sativa* L.) is one of the ideal fodder (containing 10-12 per cent protein and 30-35 per cent fibre) for milch cattle and important annual forage crop in areas having limited irrigation facilities of winter season, due to quick regrowth habit, good quality forage, better palatability, high tonnage and become a promising forage crop for the livestock production. Different improved varieties of oat (*Avena sativa* L.) are Kent, UPO-212, UPO-2005-1, NDO-1, Javi-8, OS-6, OS-7, OL-9, OL-529, HFO-114 etc. Oats (*Avena sativa* L.) are especially rich in fat, protein, vitamin B₁, phosphorus and iron (Mehra, 1978) [4]. It is highly nutritive

forage which is rich in soluble carbohydrates, due to this crop should be harvested at milking stage for making silage or hay. Being more energizing, it forms a good feed for horses, draft as well as milch animals (Kumar and Ramawat, 2007) [3].

Materials and methods

A field experiment was conducted to evaluate the “To study the economics of forage yield of promising varieties of oat (*Avena sativa* L.)” This chapter deals with the concise description of the materials used and the experimental techniques adopted during the course of investigation.

1. Experimental site

The experiment was conducted during *rabi* season at the Instructional Farm, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.).

2. Geographical situation

Raipur is situated in the plain region of C.G. state and lies at 21° 16’ North Latitude and 81° 36’ East Longitude at an altitude of 298.56 meters above the mean sea level (MSL).

3. Climatic condition

Raipur (capital of C.G.) comes under dry sub humid to semi dry agro-climatic zone, receiving an average rainfall of 1150 mm annually out of which about 88% is received during the rainy season (June to September) and the rest 12% during winter season (October to February). The maximum temperature goes as high as 48°C during summer and minimum as low as 6 °C during winter. Relative humidity is high from June to October and shows a declining trend there after with an absolute minimum during peak winter (January).

4. Weather condition during the crop growth period

The weekly meteorological data of rainfall, temperature, relative humidity and PET from December to February. The crop growth period received only 19.2 mm total rainfall. The maximum mean temperature for different months varied from 24.4-31.2 °C. The relative humidity was varying from 74-93 percent. Thus; weather ingredients were favorable during crop growth period. The open pan evaporation value ranged from 2.1 mm to 4.4 mm day⁻¹. The maximum sunshine hours 9.5 hour in third standard metrological week of January and minimum 2.3 hours day⁻¹ in first week of February.

5. Physico-chemical characteristics of the soil

Soil samples from 0-30 cm depth were collected from 16 randomly selected spots in the experimental area, prior to start the field experiment with the help of soil auger and then a composite sample was prepared for mechanical and chemical analysis. The soil of experimental field was sandy loam in texture locally known as *Matasi* (Inceptisol). The soil was natural in reaction, low in organic carbon and medium in nitrogen (259.52), phosphorus (12.20) and potash (267.50).

6. Cropping history of the experimental field

Sorghum–Berseem-Sorghum cropping sequence was followed in the experimental field since last two year. It is obvious that Sorghum was taken as main crop in *Kharif* season followed by Berseem in *rabi*. The recommended levels of fertilizers along with their agronomic practices were in general adopted on the crop during the past two years for forage crop production.

Table 1: Physico-chemical properties of the soil (0-30 cm soil depth)

S.N.	Particulars	Values	Class	Method used
	Physical Properties			
A	Mechanical composition			International pipette method (Black, 1965)
	Sand (%)	24.70	Sandy	
	Silt (%)	21.80	Loam	
	Clay (%)	53.50	<i>Inceptisol</i>	
B	Chemical Properties			
	a. Organic carbon (%)	0.36	Low	Walkley and black’s method (Piper, 1950)
	b. Available N(kg ha ⁻¹)	259.52	Medium	Alkaline permanganate method (Subway and Asija, 1956)
	c. Available P (kg ha ⁻¹)	12.20	Medium	Olsen’s method (Olsen, 1954)
	d. Available K(kg ha ⁻¹)	267.50	Medium	Flame photometric method (Hanway and Hiddle,1952)
	e. pH(1:2.5) Soil: water suspension	7.6	Neutral	Glass electrode pH meter (Piper, 1967)

7. Experimental details

The experiment was laid out in Factorial Randomized Block Design with three replication. The treatments were allotted to different plots by using random method. Different varieties of oat (*Avena sativa* L.) viz. UPO-2005-1(V₁), NDO-1(V₂), Kent (SC) (V₃)and OS-6 (SC) (V₄) and four levels of nitrogen viz. 0 kg ha⁻¹ (N₁), 40 kg ha⁻¹ (N₂), 80 kg ha⁻¹ (N₃) and 120 kg ha⁻¹ (N₄) are two factors were kept under different treatment combinations. The layout plan of experiment was depicted in Fig 3.3 and treatment details are presented in Table 3.2.

8. Plan and layout of the experiment

The treatments were randomly allotted as per detailed layout plan of the experiment.

Table 2: Detail of experiment

Factor A	Factor B
Varieties of oat crop	Levels of Nitrogen (kg ha ⁻¹)
UPO-2005-1	0
NDO-1	40
Kent (NC)	80
OS-6 (NC)	120
UPO-2005-1	0

Particular	Detail
Design	Factorial Randomized Block Design
Number of treatment	Sixteen
Number of replication	Three
Total number of plots	Fourty-eight
Dose of fertilizer	N as per treatments 60 kg P ₂ O ₅ ha ⁻¹
Spacing between	
A] Replication	1.0 m
B] Plot	0.5 m
C] Row	25 cm
Net plot size	3.50 m X 2.50 m = 8.75 m ²
Gross plot size	4.0 m X 3.0 m = 12.00 m ²
Gross experimental area	55.5 m X 14.0 m = 777 m ²
Date of sowing	07-12-2007
Date of harvesting	20-02-2008

9. Test crop

10. Field preparation

The field was ploughed with the help of tractor drawn cultivator twice in criss-cross direction. It was harrowed subsequently twice with tractor drawn cultivator to achieve loose and friable seed bed. Finally field was leveled by planker.

11. Seed rate and sowing methods

Oat seeds @ 90 kg ha⁻¹ were sown 3-4 cm deep apart from 25 cm row distance by line sowing method.

12. Gap filling

In all the treatments, to maintain uniform plant population gap filling was done at 10 days after sowing.

13. Fertilizer application

The required quantity of fertilizer was carried out as per the treatments. Urea and single super phosphate were used as the source of N and P respectively. Full dose of phosphorus was applied as basal and nitrogen was applied through urea as per levels of particular treatments in two split first 50 per cent at 25 DAS and 50 per cent at 50 DAS. Details of fertilizer dose were given below:

For each varieties of oat (UPO-2005-1, NDO-1, Kent (NC) and OS-6 (NC) } recommended dose of fertilizers are:

- N₁ - Nitrogen @ 0 kg ha⁻¹ + SSP @ 60 kg ha⁻¹
- N₂ - Nitrogen @ 40 kg ha⁻¹ + SSP @ 60 kg ha⁻¹
- N₃ - Nitrogen @ 80 kg ha⁻¹ + SSP @ 60 kg ha⁻¹
- N₄ - Nitrogen @ 120 kg ha⁻¹ + SSP @ 60 kg ha⁻¹

14. Weed management

Traditionally weed management techniques was adopted for weed management. Manual hand weeding was applied at 20 and 45 DAS, to check the further flushes of weeds.

Economics

The economics of the treatment has been worked out in terms of net income or return (Rs ha⁻¹) under various treatments based on current market rates of fertilizer, prevailing wages of labour and marke price of product. Based on the current price of inputs and produce net profit ha⁻¹ and Benefit: Cost ratio was worked out:

Net profit ha⁻¹ = Gross income ha⁻¹ – Cost of cultivation.

B: C ratio = $\frac{\text{Net profit}}{\text{Cost of cultivation}}$

Results and discussion

The results obtained during course of investigation are presented below under appropriate heading with table, figure and statistical interpretation. The results are discussed here in the light of scientific reasoning to understand the cause and effect relationship. Vegetative part of the plant is considered as an economic yield of forage crop. Herbage yield a combine effect of the growth parameter. It is mainly affected by genetic make-up, agro-climatic effect and management practices can be easily altered in positive way to boost the high quality forage yield. Among the various management practices, fertilizer management play vital role to boost up the herbage yield and it can be effectively modified in order to increase the productivity of a crop per unit area and per unit time.

A field experiment was carried out during *Rabi* season to study the “To study the economics of forage yield of promising varieties of oat (*Avena sativa* L.)” are presented below:

Economics

Economics of various treatments with fodder oat crop was calculated and the results are summarized in table 4.15 and depicted through fig. 4.7. The net return was highest (Rs 8580.25) in V₁ (UPO-2005-1) and B: C ratio (0.95) was also highest in V₁ (UPO-2005-1). V₃ (Kent (SC)) recorded higher net return and B: C ratio as compared to V₂ (NDO-1) and V₄ (OS-6 (SC)).

The net return (Rs 10358.37) and B:C ratio (1.14) were highest in N₃ (80 kg N ha⁻¹) among different nitrogen levels. In different combination of varieties and nitrogen levels, V₁N₄ (UPO-2005-1 + Nitrogen @ 120 kg ha⁻¹) recorded highest net return (Rs. 11405.50) and in V₁N₃ (UPO-2005-1 + Nitrogen @ 80 kg ha⁻¹) highest B:C ratio (1.25).

Sharma *et al.* (2004) observed that From the economic point of view, the highest net return per rupee invested (Rs. 1.58 ha⁻¹) was obtained in the treatment T₁₀ {50 per cent recommended dose of fertilizer + Vermicompost @2.5 tonnes ha⁻¹+ FYM @2.5 tonnes ha⁻¹} followed by T₈ (Rs. 1.55 ha⁻¹) receiving 50 per cent recommended dose of fertilizer (RDF) + Vermicompost @ 2.5 tonnes ha⁻¹. In a nutshell, considering the yield and economics, application of 50 per cent recommended dose of fertilizer (RDF) + Vermicompost @ 2.5 tonnes ha⁻¹ + FYM @ 2.5 tonnes ha⁻¹ was found to be the best among all the treatments. Rohitashav *et al.* (1998) found that the cutting of the oat crop for forage at 85 days after sowing gave 7.5 and 34.0 per cent higher net returns over no cut and cutting at 105 days after sowing respectively.

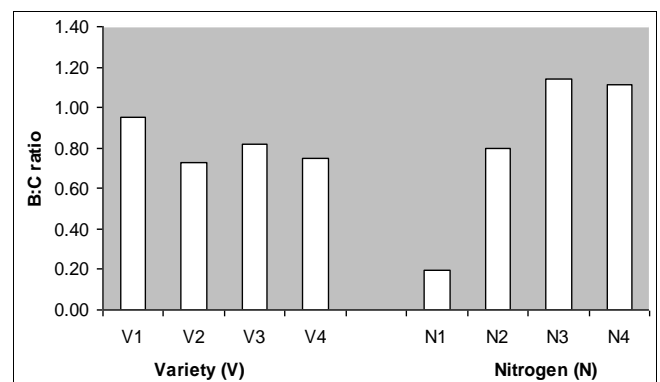


Fig 1: Benefit: cost ratio of oat as influenced by various treatments

Appendix 2: Cost of cultivation ha⁻¹ of fodder oat due to various treatments

S. No.	Particulars	Input	Rate (Rs)	Total Cost (Rs ha ⁻¹)
A	Fixed cost			
1.	Land preparation			
i	Ploughing	1 Tractor 3 hr.	180.00 ha ⁻¹	540
ii	Harrowing	1 Tractor 2.5 hr.	180.00 ha ⁻¹	400
iii	Rotavating	1 Tractor 2.5 hr.	180.00 ha ⁻¹	360
2.	Sowing			
i	Fertilizer application	4 Labour	80.00 day ⁻¹	320
	phosphorus	60 kg ha ⁻¹	15.00 kg ⁻¹	900
ii	Cost of sowing	10 Labours	80.00 day ⁻¹	800
	Cost of seed	90 kg ha ⁻¹	25.00 kg ⁻¹	1750
3.	Interaculture	8 Labours	80.00 day ⁻¹	640
4.	Fodder cutting	20 Labours	80.00 day ⁻¹	1600
5.	Land revenue	For 6 months	200	200
6.	Miscellaneous	@10%		751
	total cost			8261
B	Variable cost			
1.	Urea			
	N ₁	No Urea	10.00 kg ⁻¹	0
	N ₂	40 kg ha ⁻¹	10.00 kg ⁻¹	400
	N ₃	80 kg ha ⁻¹	10.00 kg ⁻¹	800
	N ₄	120 kg ha ⁻¹	10.00 kg ⁻¹	1200

Appendix II

Treatments	Cost of cultivation	*Produce yield (q ha ⁻¹)	Gross return (Rs)	Net return (Rs)	B: C ratio
V ₁ N ₁	8261	207.07	10353.5	2092.5	0.25
V ₁ N ₂	8661	363.52	18176	9515	1.10
V ₁ N ₃	9061	407.38	20369	11308	1.25
V ₁ N ₄	9461	417.33	20866.5	11405.5	1.21
V ₂ N ₁	8261	190.03	9501.5	1240.5	0.15
V ₂ N ₂	8661	288.36	14418	5757	0.66
V ₂ N ₃	9061	373.06	18653	9592	1.06
V ₂ N ₄	9461	386.8	19340	9879	1.04
V ₃ N ₁	8261	200.53	10026.5	1765.5	0.21
V ₃ N ₂	8661	304.94	15247	6586	0.76
V ₃ N ₃	9061	393.94	19697	10636	1.17
V ₃ N ₄	9461	404.19	20209.5	10748.5	1.14
V ₄ N ₁	8261	192.83	9641.5	1380.5	0.17
V ₄ N ₂	8661	289.21	14460.5	5799.5	0.67
V ₄ N ₃	9061	379.17	18958.5	9897.5	1.09
V ₄ N ₄	9461	390.02	19501	10040	1.06

*Produce price Rs 50 q⁻¹**References**

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