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EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND ECONOMICS OF FODDER OATS (*AVENA SATIVA* L.)

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SUMMARY

A field experiment was conducted at Instructional Farm,College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Rabi* 2019-20 to study the "Effect of integrated nutrient management on growth, yield and quality of fodder oats (*Avena sativa* L.)". Fourteen INM treatment *viz*.100 % RDF, 100% RDF + FYM @ 20.0 t /ha, 100 % RDF + PSB, 100% RDF + PSB + Znso4 @ 12.5 kg /ha, 75% RDF, 75% RDF + Vermicompost @ 5.0 t /ha, 75% RDF + Vermicompost @ 2.5 t /ha, 75% RDF + Vermicompost @ 2.5 t /ha + PSB, 75% RDF +Vermicompost @ 2.5 t /ha + $ZnSO_4$ @12.5 kg /ha, 75% RDF + FYM @ 20.0 t /ha,75% RDF + FYM @ 10.0 t /ha,75% RDF + FYM @ 10.0 t /ha + PSB,75% RDF + FYM @ 10.0 t /ha + PSB + $ZnSO_4$ @12.5kg/ha, Control (untreated) were laid out in randomized block design with three replications. The results revealed that application of all treatments were significant increased all growth and yield parameters, but 75% RDF + FYM @ 10 t /ha + PSB + $ZnSO_4$ @ 12.5 kg /ha gave highest plant growth, fresh and dry weight, green fodder yield /ha, leaf stem ratio over rest of the treatments, only 75% RDF + FYM @ 20.0 t /ha and 75% RDF + FYM @ 10.0 t/ha were found at par. This treatment also gave maximum returns as compare to rest of the treatments.

Key words : Fodder yield, INM, Net returns, PSB, Vermicompost etc.

In India, the livestock is an integral component of agriculture economy, which contributes about 4.11% to total GDP of world's livestock population (DAHD & F 2017-18). Livestock production is backbone of Indian agriculture. Total number of cattle 192.49 million, buffaloes 109.85 million, goat 148.88 million, Sheep 74.26 million in the population of animals (Livestock Census 2019). India ranks first in terms of milk production (129.7 million tonnes), however, the productivity is quite low mainly because of scarcity of feeds and fodders. Recent reports clearly indicated thatIndia faces a net deficit of green fodder by 61.1%, drycrop residues by 21.9% and for feeds as high as 64% (Kumar *et al.*, 2012). Fodder requirement of India is 530 million tones dry matter and 851million tones green fodder but present supply is 467 million tones and 590 million tones dry and green respectively. So, there is a huge gap in demand and supply. Deficiency of fodder in country 35.6% in green fodder and 10.95% dry crop residue (Anonymous 2019). Fodder oats are usually winter sown, grazed prior to stem elongation and left to mature for its use as feed or milling grains. Multiple cuts are usually taken, after which part or all of the crop may be saved for seed (Kumar *et al*., 2010). Among the different *Rabi* fodder crops, oats (*Avena sativa* L.) is one of the most important rabi fodder crop. Oats rank fifth in terms of world cereal production. It is extensively grown as forage crop and gaining importance in many regions of the world. The oat crop can also tolerate drought, chilling and salinity stress upto some extent (Devi *et al.,* 2019). It is the most important winter cereal fodder, which is highly palatable, rich source of energy, protein, vitamin B_1, phosphorus, iron and other minerals. Recent researches indicate that a judicious combination of fertilizer and organic manures can better increase the production of fodder crops. Therefore, the basic concept of integrated plant nutrient system is improvement and maintenance of soil fertility for sustaining crop productivity on long-term basis. Application of different organic-inorganic sources was found very effective in realizing high yield, improved residual fertility and better economy of the soil. Therefore, the present study was undertaken to assess the effect of INM on yield and quality of oats.

MATERIALS AND METHODS

The experiment effect of integrated nutrient management on growth and yield of forage oat

wascarried out at the Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Rabi* 2019-20. Soil samples were taken before sowing of crop at a depth of 30 cm for physio-chemical analysis. Soil was loamy sand in texture and slightly alkaline in reaction (pH 8.5), poor in organic carbon (0.16 per cent), low in available nitrogen (90 kg /ha), medium in available phosphorus (18.68 kg/ha),potassium (214.6 kg /ha) and Zn (0.34-0.36).The experiment was laid out in Randomized Block Design with three replications. Total fourteen treatments *viz.,* 100% RDF (T_1), 100% RDF+ FYM @ 20.0 t/ha (T_2), 100% RDF+PSB (T_3), 100% RDF + PSB + $ZnSO_4$@ 12.5 kg/ha (T_4), 75% RDF (T_5), 75% RDF + Vermicompost @ 5.0 t/ha (T_6), 75% RDF + Vermicompost @ 2.5 t/ha (T_7), 75% RDF + Vermicompost @ 2.5 t/ha+PSB (T_8), 75% RDF + Vermicompost @ 2.5 t/ha+$ZnSO_4$@ 12.5 kg /ha(T_9), 75% RDF+FYM @ 20.0 t /ha (T_{10}) 75% RDF + FYM @ 10.0 t/ha (T_{11}) 75% RDF + FYM @ 20.0 t/ha +PSB (T_{12}), 75% RDF + FYM @ 10.0 t /ha+ PSB + $ZnSO_4$@ 12.5 kg/ha (T_{13}), Control (T_{14}) were comprised in oat crop. The crop was sown at 20 cm apart rows with using 100 kg of seed /ha. As per treatments well rotted FYM and vermicompost were applied before sowing and thoroughly mixed in the plots. PSB, Full dose of phosphorus and half dose of nitrogen were applied at the time of sowing and the remaining halfnitrogen at the time of first irrigation. All other agronomic practices were kept normal and uniform for all the treatments. The growth and fodder yield parameters were recorded by standard procedure In order to test the significance of variance in experiments, the data obtained for various treatment effects were statistically analyzed using the F-test as per procedure described by (Panse and Sukhatme, 1985). The results are presented at 5% level of significance (P=0.05) for making comparison between treatments.

RESULTS AND DISCUSSION

Growth parameters

In the present investigation, growth and yield parameters *viz,* plant height, fresh weight, dry weight, and leaf: stem ratio of fodder oat were influenced significantly by integrated nutrient management. The data showed that different combinations of nutrient with different sources were increased all growth parameter as compare to single sources of nutrients (Table 1) Application of 75% RDF + FYM @ 10.0 t / ha+ PSB + $ZnSO_4$@ 12.5 kg /ha gave the maximum plant height, fresh weight, leaf: stem ratio of oats as compare other remaining treatments. Similar result showed that (Zada *et al*., 2000), and (Ahmad*etal*., 2011). It may be narrated that 75% RDF + FYM @ 10.0 t /ha+ PSB + $ZnSO_4$@ 12.5 kg /haproved most suitable organic with inorganic fertilizer treatment combination for increasing the plant height, fresh and dry weight of oat crop, it might be due to cumulative

TABLE 1
Effect of various treatment on plant height, leaf:stem, fresh weight, Dry weight

Treatments	Plant height (cm)	Leaf : stem	Fresh weight (g/m row length)	Dry weight (g/m row length)
100 % RDF	78.56	0.34	529.33	180.25
100% RDF+FYM @ 20.0 t /ha	84.88	0.43	591.84	231.02
100 % RDF+PSB	79.05	0.36	531.79	178.47
100% RDF+PSB+$ZnSO_4$ @ 12.5 kg /ha	83.68	0.40	555.07	180.20
75% RDF	69.83	0.31	386.68	140.03
75% RDF+Vermicompost @ 5.0 t /ha	76.06	0.33	488.86	178.49
75% RDF+Vermicompost @ 2.5 t /ha	71.28	0.31	406.82	161.87
75% RDF+Vermicompost @ 2.5 t /ha+PSB	74.21	0.32	428.42	163.33
75% RDF+Vermicompost @ 2.5 t /ha+$ZnSO_4$ @ 12.5 kg /ha	76.86	0.33	443.37	160.11
75% RDF+FYM @ 20.0 t /ha	83.48	0.40	610.12	215.79
75% RDF+FYM @ 10.0 t /ha	79.10	0.36	548.48	196.80
75% RDF+FYM @ 10.0 t /ha+PSB	82.96	0.38	512.11	203.39
75% RDF+FYM @ 10.0 t /ha+PSB+$ZnSO_4$ @ 12.5 kg /ha	85.81	0.47	660.17	243.50
Control	66.68	0.30	358.51	126.76
SEm±	1.57	0.02	28.27	10.12
C.D. at 5%	4.58	0.07	82.18	29.41

effect of FYM. Similar findings were reported by (Zada *et al.*, 2000), and (Ahmad, *etal.*, 2011). It is an established fact that organic manures improves the physical, chemical and biological properties of soil and supplies almost all the essential plant nutrients for growth and development of plants. Application of organic manures like farmyard manure might have improved the soil properties. Effect of manure on plant growth and productivity may be ascribed to its direct and indirect involvement in the availability of nutrients to crop plants (Singh and Sinsiwar, 2006). The increase in leaf: stem ratio due to the 75% RDF + FYM @ 10.0 t /ha+ PSB + $ZnSO_4$@ 12.5 kg /hacan be explained by the fact that nitrogen, phosphorus and zinc promotes plant growth which was increases number of leaves /plantand shoot diameter. Increase in higher leaf-stem ratio with application of FYM is indicative of better plant growth and development under FYM (Kumar *et al.*,2022).

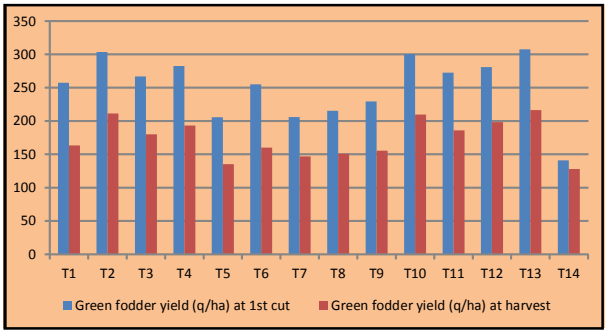

Fig. 1. Effect of integrated nutrient management on green fodder of oats.

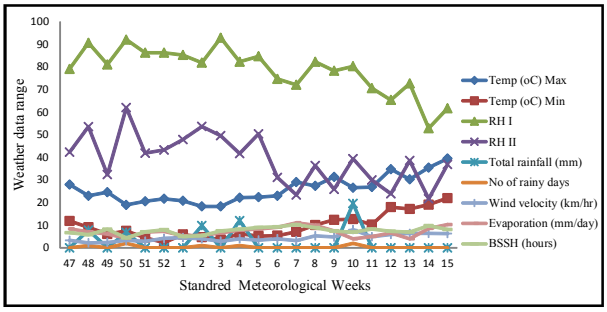

Fig. 2. Mean weekly meteorological data recorded during crop growing inrabi season, 2019-20.

Fodder yield and productivity

Data (Table 2 & Fig. 1) revealed that green fodder yield of fodder oats influenced significantly by integrated nutrient management. Highest green fodder yield 307.50 q/ha by 1st cut, 216.39 q/ha by harvest and total 523.89 q/ha and recorded with application of 75% RDF + FYM @ 10.0 t /ha + PSB + $ZnSO_4$@ 12.5 kg /ha was significantly higher as compared 100 % RDF, 100 % RDF + PSB, 100% RDF + PSB + $ZnSO_4$@ 12.5 kg /ha,75% RDF, 75% RDF + Vermicompost @ 5.0 t /ha, 75% RDF +Vermicompost @ 2.5 t /ha, 75% RDF + Vermicompost @ 2.5 t /ha +

TABLE 2
Effect of various treatment on fodder yield,green fodder productivity and net return and B:C ratio

Treatments	Green fodder yield (q/ha)			Green fodder productivity (q/ha)	Economics	
	At 1st cut	At harvest	Total		Net returns (Rs./ha)	B : C ratio
100 % RDF	257.40	163.33	420.73	3.57	81138	3.37
100% RDF+FYM @ 20.0 t/ha	303.61	211.39	515.00	4.36	86561	2.05
100 % RDF+PSB	266.94	180.00	446.94	3.79	87251	3.56
100% RDF+PSB+$ZnSO_4$ @ 12.5 kg/ha	282.50	193.33	475.83	4.03	90307	3.15
75% RDF	205.55	135.28	335.83	2.85	60773	2.62
75% RDF+Vermicompost @ 5.0 t/ha	255.00	160.00	415.00	3.52	53355	1.06
75% RDF+Vermicompost @ 2.5 t/ha	205.83	146.94	352.78	2.99	51407	1.40
75% RDF+Vermicompost @ 2.5 t/ha+ PSB	215.28	150.83	366.11	3.10	54300	1.46
75% RDF+Vermicompost @ 2.5 t/ha+$ZnSO_4$ @ 12.5 kg/ha	229.44	155.55	385.00	3.26	55297	1.35
75% RDF+FYM @ 20.0 t/ha	300.28	209.72	510.00	4.32	86171	2.09
75% RDF+FYM @ 10.0 t/ha	272.50	185.83	458.33	3.88	82327	2.55
75% RDF+FYM @ 10.0 t/ha+PSB	280.83	198.33	479.16	4.06	87095	2.66
75% RDF+FYM @ 10.0 t/ha+PSB+$ZnSO_4$ @ 12.5 kg/ha	307.50	216.39	523.89	4.44	94110	2.55
Control	140.83	128.06	268.89	2.28	46622	2.26
SEm±	8.03	5.96	10.43	0.09	2608	0.08
C.D. at 5%	23.33	17.33	30.32	0.26	7581	0.24

PSB, 75% RDF + Vermicompost @ 2.5 t /ha + $ZnSO_4$@ 12.5 kg /ha , 75% RDF + FYM @ 10.0 t / ha, 75% RDF + FYM @ 10.0 t /ha + PSB and control. It was 68.98 per cent higher over control, but remained at par with100% RDF + FYM @ 20.0 t /ha and 75% RDF + FYM @ 20.0 t /ha. Similar results were also found by Pandey (2018) and (Biswasa *et al*., 2020).

Green fodder productivity per day of oats also influenced significantly by application of integrated nutrients (Table 2). Maximum green fodder productivity per day was produced under application of 75% RDF + FYM @ 10.0 t /ha + PSB + $ZnSO_4$@12.5 kg /ha(4.44 q/ha), it was at par with 100% RDF + FYM @ 20.0 t /ha and 75% RDF + FYM @ 20.0 t /ha and proved significantly higher over rest of treatments.

ECONOMICS

Application of integrated nutrient management treatments brought about a significant improvement in net returns from fodder oat (Table 2). Maximum net returns were fetched under application of 75% RDF + FYM @ 10.0 t /ha+ PSB + $ZnSO_4$ @ 12.5 kg/ha (Rs. 94110 /ha), it was near to 100% RDF + FYM @ 20.0 t/ha (Rs. 86561/ha), 100 % RDF + PSB (Rs. 87251 /ha), 100% RDF + PSB + $ZnSO_4$ @ 12.5 kg /ha (Rs. 90307 /ha) and 75% RDF + FYM @ 10.0 t /ha+ PSB (Rs. 87095 / ha), and significantly higher over rest of integrated nutrient management treatments. This may be attributed due to better nutrients uptake and higher fodder yield similar findings recorded by (Deva *et al.,* 2014).Application of integrated nutrient management treatments brought about a significant improvement in B:C ratio of fodder oat (Table 2). Highest B:C ratio was recorded under application of 100% RDF + PSB, which was significantly higher over rest of integrated nutrient management treatments. This may be attributed due to lower cultivation cost of 100% RDF + PSB and 100% RDF application as compare to other integrated nutrients combination.

CONCLUSION

It is concluded that the application of 75% RDF + FYM @ 10.0 t /ha+ PSB + $ZnSO_4$ @ 12.5 kg/ ha gave significantly higher growth parameters *viz,* plant height, fresh weight, dry weight, leaf : stem ratio, and fodder yield and productivity of oat.

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