Original Research Article

Effect of Natural Farming, Organic, Inorganic and Integrated Nutrient Management on Growth, Yield and Economics of Fodder Oat

ABSTRACT

A field experiment was conducted at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during *Rabi* 2021-2022 to study the effect of natural farming, organic, inorganic and integrated nutrient management on growth, yield and economics of fodder oat. The experiment was laid out in randomized block design with three replications, comprising of six nutrient management treatments. Inorganic nutrient management and integrated nutrient management (FYM @ 5 t/ha + 50 percent of recommended dose of fertilizers) behaving alike resulted in significantly better crop growth (plant height, numbers of shoots per square meter and dry matter accumulation) and higher fodder yield (green and dry) as compared to farmer's practice(FYM @ 2.5 t/ha + 25 percent of recommended dose of fertilizers), organic nutrient management (FYM @ 10 t/ha + *Jeevamrit*) and natural farming nutrient management (*Beejamrit* + *Jeevamrit* + mulching) treatments. Inorganic nutrient management proved most profitable with highest net returns and net returns per rupee invested.

Keywords:*fodder oat,inorganic, natural farming, nutrient management*

1. INTRODUCTION

Oat is one of the most important *Rabi* season fodder crop. It is a quick growing, palatable, succulent, nutritious and having luxuriant growth. It contains 6-10 percent protein and 18-30 percent dry matter (Chahal 2019). In world, total area under fodder oat cultivation is 27 million hectares which accounts to total production of 40 milliontone's (Anonymous 2020). In India, oat is grown in an area of about one million hectare with green fodder productivity of 35-50 tone's/hectare (Anonymous 2019). Oat is mainly grown under inorganic nutrition condition.

Chemical fertilizers have the ability to fulfill the nutrient demand of fodder oat. But the poor socio-economic conditions of small and marginal farmers restrict the use of chemical fertilizers on one hand. And on the other, indiscriminate use of chemical fertilizers alone has led to environment pollution and deterioration of soil physical, chemical and biological properties (Pandey and Singh 2021).

Organic manures, in improving the soil fertility is well documented but it seems difficult to meet the nutritional requirements of crop in the country through organic sources. Therefore, integrated nutrient management in which both organic manures and inorganic fertilizer are used simultaneously is probably the most effective method to maintain soil fertility, while increasing crop productivity and profitability.In recent years, Subhash Palekar Natural Farming (SPNF)" proposed by Padamashri Subhash Palekar has also emerged as a good alternative to inorganic and organic farming. SPNF is claimed to sustain the production and maintain the ecological balance. It is based on the principle of utilizing cheap and locally available inputs with zero utilization of chemicals in any form like fertilizers and pesticides. One of the major components of this farming is rearing of indigenous cattle whose urine and dung are critical

ingredients of *Beejamrit* and *Jeevamrit*. *Jeevamrit* prepared on-site is central to this practice, enhances microbial activity in soil and helps in improvement of soil fertility (Chaudhary et al. 2022). Keeping in view the above facts and to evaluate different nutrient management practices in fodder oat, the present experiment was under taken.

2. MATERIALS AND METHODS

A field experiment was conducted at the Research Farm of the School of Agriculture, Abhilashi University, Mandi (H.P.) during *Rabi* 2021-2022. Soil of the experimental field was acidic in reaction (5.5), medium in organic carbon (0.72%), low in available nitrogen (238 kg/ha), medium in available phosphorus (15.52 kg/ha) and available potassium (206 kg/ha). The experiment was laid out in randomized block design with three replications, consisting of six nutrient management treatments *i.e.* absolute control (T_1), natural farming nutrient management(seed treatment with *Beejamrit* + soil treatment with *Jeevamrit* as basal and at 21 days interval + mulching) (T_2), organic nutrient management(FYM @ 10 t/ha + 3 sprays of *Jeevamrit*) (T_3), farmer's practice (FYM @ 2.5 t/ha + 25 percent recommended dose of fertilizers) (T_4), integrated nutrient management (FYM @ 5 t/ha + 50 percent recommended dose of fertilizers) (T_5) and 100 percent recommended dose of fertilizers (T_6).

Oat variety 'Kent' was sown at 20 cm row to row spacing using seed rate of 100 kg/ha. Before sowing of oat, full dose of FYM on dry weight basis was applied as per treatment and thoroughly mixed with the soil. The crop was fertilized with recommended dose of nitrogen, phosphorus and potassium *i.e.* 120, 60 and 40 kg/ha through urea, single super phosphate and murate of potash as per treatments at the time of sowing. Half dose of N, whole of P and K as per treatments was applied at the time of sowing of crop. The remaining half dose of N was top dressed after 30 days of sowing of crop. *Beejamrit* was prepared on the farm itself as per the seed requirement. The ingredients for treating 100 kg of seeds @ 25 liters of *Beejamrit* were local cow dung (5kg), local cow urine (5 liters), lime (50 g), soil (200 g) and water (20 liters). *Jeevamrit*, fermented liquid organic manure was prepared on the farm itself. The ingredients for 2 liters of *Jeevamrit* were cow dung (100 g), cow urine (100 ml), jaggery (20 g), pulse floor (20 g), soil (2 g) and water (2 liters). *Jeevamrit* was kept for 48 hours in the shadow for fermentation. Thereafter, dilution of 10 percent from the concentrated *Jeevamrit* were prepared and used at the rate of 500 l/ha in the respective treatments. The inputs of natural farming were prepared as per the procedure proposed by Subhash Palekar (Palekar 2006). In natural farming nutrient management treatment, paddy straw was used as mulching material. Mulching was applied at 30 days after sowing and it was maintained till the maturity of crop.

The growth of crop was determined in the terms of plant height, number of shoots and dry matter accumulation at each cut. The fodder cut of oat were taken and total yield of both cuts was calculated in tonnes per hectare. Economics of different treatments was calculated taking into account of the prevailing market prices of inputs and outputs. The data recorded on various aspects in the present study were subjected to the statistical analysis using analysis of variance as per procedure suggested by Gomez and Gomez (1984).

3. RESULTS AND DISCUSSION

Growth attributes

The growth attributes of fodder oat *viz.*mean plant height (cm), mean shoot number (per m^2) and total dry matter accumulation (g/m^2) of two cuts were significantly affected by different nutrient management treatments (Table 1).Significantly taller plants, higher number of shoot per meter square and dry matter accumulation of oat was produced with inorganic nutrient management which remained statistically at par with integrated nutrient managementtreatment comprised of FYM @ 5 t/ha + 50 percent of recommended dose of fertilizers. Following to, farmer's practice of FYM @ 2.5 t/ha + 25 percent of recommended dose of fertilizersresulted in taller plants, higher number of shoots and dry matter accumulation than organic nutrient management (FYM @ 10 t/ha + *Jeevamrit*) and natural farming nutrient management (*Beejamrit* + *Jeevamrit* + mulching) treatments. Minimum plant height, lowest shoot count and dry matter accumulation of oat was recorded with absolute control which did not differ significantly from natural farming nutrient management treatment.

Better plant height and higher number of shoots of oat with inorganic and integrated nutrient management might be attributed to increased availability of nutrients particularly nitrogen which induced rapid cell division, cell elongation and meristematic activity (Dar et al. 2014).The effect on dry matter accumulation of crops in different treatments can be ascribed to growth attributes *viz.* plant height and shoot number under the present study. Under inorganic and integrated nutrient management, the enhanced availability of nutrients helped in increasing leaf area resulting in more dry matter production. The results are in conformity withthe findings of Jat et al. (2017) and Deva et al. (2017).

Table 1. Effect of different nutrient management practices on growth parameters of fodder oat

Treatments	Plant height (cm)	Shoot number (per m^2)	Dry matter accumulation (g/m^2)
Absolute control	38.3	270	255.18
Natural farming nutrient management	42.5	291	294.13
Organic nutrient management	49.8	304	358.25
Farmer's practice	57.9	325	416.26
Integrated nutrient management	66.5	361	515.05
Inorganic nutrient management	70.0	371	551.51
SEm±	2.26	9.00	18.35
CD(P)=0.05	6.79	27	55.07

Yield

The different treatments had significant effect on total green and dry fodder yields of oat.Inorganicnutrient management resulted in significantly higher green and dry fodder yields of oat, which was statistically at par with integrated nutrient management treatment comprised of FYM @ 5 t/ha + 50 percent of recommended dose of fertilizers. Comparison of other nutrient management practices indicated that, farmer's practice of FYM @ 2.5 t/ha + 25 percent of recommended dose of fertilizers produced higher green and dry fodder yields as compare to organic nutrient management (FYM @ 10 t/ha + *Jeevamrit*) and natural farming nutrient management (*Beejamrit* + *Jeevamrit* + mulching) treatments. Significantly lower green and dry fodderyields were obtained under the control condition which was statistically at par with natural farming nutrient management treatment.Inorganic nutrient management treatment produced 54.24, 47.93, 33.73, 20.07and 6.20 percent more total green fodder yield and 55.55, 48.26, 35.88, 22.76 and 6.08 percent total dry fodder yield over absolute control, natural farming nutrient management, organic farming nutrient management, farmer's practice and integrated nutrient management treatments, respectively(Table.2).

Inorganic and integrated nutrient management treatments produced higher green fodder yield than the farmer's practices and treatments having organic or natural farming sources of nutrients. Similar effects of treatments on yield were also obtained by Patel and Sahu (2014), Kumari et al. (2014) and Luikham et al. (2012). Higher value of vegetative growth in terms of plant height, higher shoot number per m^2 and dry matter accumulation was observed with inorganic and integrated nutrient management treatments. Increase in green fodder yield with the application of recommended dose of fertilizer might be ascribed to adequate availability of nitrogen which increased protoplasmic constituents, accelerated cell division and elongation which in turn give luxuricent vegetative growth and relatively higher forage yield (Jat et al. 2017). The integrated use of FYM with 50 percent recommended dose of N through inorganic sources might have attributed to improved nutrient supply, soil health and increase in soil microbial activity which in turn increased the enzymes responsible for conversion of unavailable form of nutrient to available from leading to higher nutrient uptake and increase in yield (Gore and Sreenivasa 2011). The study further indicated that organic nutrient management resulted in significantly higher green and dry fodder yields than natural farming nutrient management which might be ascribed to mineralization of FYM which makes nutrients available to crop for prolonged period (Biswas et al. 2020). The amount of nutrients added by *Jeevamrit* in natural faming nutrient management was very low which lead to starvation of plant for nutrients.

ECONOMICS

It is evident from the data presented in table 2 that inorganic nutrient management obtained highest net returns of ₹ 54610 per ha followed by integrated nutrient management treatment of FYM @ 5 t/ha + 50 percent of recommended dose of fertilizers (₹ 40751 per ha) and farmer's practice of FYM @ 2.5 t/ha + 25 percent recommended NPK(₹ 35858 per ha) remaining statistically at par with each other. Significantly the lowest net returns of ₹ 6417 per ha were obtained from organic nutrient management i.e. FYM @ 10 t/ha + *Jeevamrit,* which was at par with natural farming nutrient management treatment of *Beejamrit* + *Jeevamrit* + mulching(₹ 15337 per ha) and absolute control (₹ 12756 per ha). Inorganic nutrient management resulted in highest net returns per rupees invested (1.56). This was followed by farmer's practice of FYM @ 2.5 t/ha + 25 percent recommended dose of fertilizers(1.00) and integrated nutrient management treatment of FYM @ 5 t/ha + 50 percent of recommended dose of fertilizers(0.94). Significantly the lowest net returns per rupees invested of 0.12 obtained from organic nutrient management treatment *i.e.* FYM @ 10 t/ha + *Jeevamrit* which was statistically at par with absolute control.

Table 2. Effect of nutrient management practices on yieldand economics offodder oat

Treatments	Total green fodder (t/ha)	Total dry fodder (t/ha)	Net returns(₹ /ha)	Net returns per rupee invested
Absolute control	12.83	2.44	12756	0.45
Natural farming nutrient management	14.60	2.84	15337	0.49
Organic nutrient management	18.58	3.52	6417	0.12
Farmer's practice	22.41	4.24	35858	1.00
Integrated nutrient management	26.30	5.15	40751	0.94
Inorganic nutrient management	28.04	5.49	54610	1.56
SEm±	1.15	0.21	3699	0.10
CD(P)=0.05	3.46	0.65	11098	0.31

The enhanced yield under inorganic nutrient management resulted in higher gross returns, net returns and net returns per rupee invested. The difference of green fodder yield between integrated and inorganic nutrient management treatments was less but increased cost of cultivation because of higher cost of FYM application made integrated nutrient management less profitable in terms of net returns and net returns per rupee invested. Green fodder yield obtained in natural farming nutrient management was significantly lower than organic nutrient management, but on farm preparation of *Jeevamrit* and *Beejamrit* made natural farming nutrient management profitable than organic nutrient management. These findings are in agreement to those of Kumar and Dhar (2006).

4. CONCLUSION

It is concluded that inorganic and integrated nutrient management proved better than farmer's practice, organic and natural farming nutrient management in terms of better growth, higher yield (green and dry) and economics of fodder oat.

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