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Effect of fertility levels and cow urine application as basal and foliar spray on quality and nutrient content of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson]

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Abstract

Cow urine as a nutrient source along with different fertility levels on mustard is studied at IFS block institute of agricultural science BHU. A split plot field experiment was conducted on mustard (*Brassica juncea* L. Czern & Coss var. Kalasona) during 2014-15 at the IFS block of Agricultural Research Farm, Department of Agronomy, BHU to examine the effect of fertility levels and cow urine application as basal and foliar spray on nutrient content and quality of Indian mustard [*Brassica juncea* (L.) Czernj. & Cosson]. The Oil yield (kg ha⁻¹), Seed protein content (%), Protein yield (kg ha⁻¹) and NPK content of seed and stover except P content in seed were observed significantly highest with higher dose of fertilizer dose i.e. 100% recommended dose of fertilizers (RDF), i.e. 100:50:50:40, compared to 75% RDF. Among the urine levels basal urine application of 1200 l ha⁻¹ and foliar spray of 50% recorded highest oil and protein yield. N, P, K content of seed and stover were recorded higher with combined application of 100% RDF, basal cow urine level of 1200 l ha⁻¹ and foliar spray of 50% urine.

Keywords: Cow urine, oil content, protein content, Fertility level, Growth, Indian mustard

Introduction

Mustard is an important rabi season annual oilseed crop grown with a production India occupying 6.7 Mha acreage, 6.4 Mt production and 955 kg/ ha productivity (Anonymous, 2018). [2] It is an energy rich crop requiring higher amount of nutrients. Continuous use of higher dose and imbalance chemical fertilizer has deteriorated the soil health, water resource, crop growth and quality of the food. In the absence of organic manure addition and application of higher dose of macro nutrient chemical fertilizer soil productivity declines, may be due to deficiencies of secondary nutrients and micronutrients. In this manner, it is important to enhance and maintain the inherent soil nutrients with agricultural wastes, organic manures, biofertilizers and their synergistic impact with agrochemicals for improving productivity, profitability and sustainability of agriculture. In India, many of rural family have cow. Cow urine is a source of water 95%, urea 2.5%, hormones, salt, minerals, and enzymes 2.5%. It also contains essential minerals like phosphorus, potassium, iron, calcium, uric acid, amino acids, enzymes, cytokine and lactose, etc (Bhadauria, 2002) [3]. As it is organic whenever utilized in crops has no unfavorable effect on soil biology and human health. It helps in improving the soil texture and as a plant hormone additionally have been addressed to the micronutrient deficiency. With these views, a field experiment was led to investigate the possibility of supplementation of chemical fertilizer with cow urine.

Materials and Methods

A field trial was laid out in a split plot design during rabi season of 2014-15 at IFS Block of Agricultural Research Farm, Department of Agronomy, Institute of Agricultural Sciences, BHU, Varanasi (UP). The experimental soil was sandy clay loam in texture with poor in organic carbon (0.38%) and slightly alkaline (pH 7.7). The available N, P₂O₅ and K₂O content of soil were 137.5, 23.8 and 172.3 kg ha⁻¹ respectively. Data on meteorological parameters recorded during the period of experimentation at the meteorological observatory of the

Agricultural Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, have been presented in Fig. 1. The total treatment combinations were eighteen and replicated thrice involved main plot treatment consisted with combination of two fertility gradients, i.e. F₁-75% and F₂-100% RDF (Recommended fertilizers dose) and three cow urine levels as basal application i.e. U₁- 400, U₂-800, U₃-1200 l ha⁻¹. The sub plot consisted of three cow urine levels as foliar spray (S₁-0%, S₂-25% and S₃-50%) that applied @ 600 l ha⁻¹ at 30, 50 and 70 DAS. The recommended dose of fertilizer applied as per the treatment through urea, DAP, MOP and elemental sulphur respectively. Half quantity of N with full quantity of P, K and sulphur as per treatment were applied as basal dose and the remaining dose of nitrogen was top dressed through urea at 30 DAS after the first irrigation. As per the treatment cow urine with or without water was applied as basal dose just before the sowing in furrows through rose can. Application of foliar spray of cow urine was done as per the treatment at 30, 50 and 70 DAS. A seed rate of 5.0 kg/ha of variety 'KALASONA' was used for the experiment at a row spacing of 40 cm and plant to plant at a distance of 15 cm to maintain plant geometry of 40 × 15 cm. Pre emergence herbicide Pendimethalin 30EC@1Kg ha⁻¹ was used which was followed by one mechanical-cum-manual weeding at 4 week stage of the crop. To maintain optimum soil moisture one pre and one post sowing irrigation were applied for plant growth. Analysis of soil and plant for organic C and available N, P, K content was done as per the standard Walkley and Black's rapid titration, alkaline potassium permanganate, Olsen, neutral ammonium acetate method respectively. The cow urine which used in the experiment content nutrient available are given below.

N	P	K	S	Ca	Mg
0.97%	0.08%	1.1%,	0.09ppm	0.01ppm	0.1ppm

Results and Discussion

Mustard seed are rich source of essential oil minerals and vitamins. Quality parameter includes, oil yield, oil percentage, protein content etc. Synthesis of oil by plant organs is a complicated series of bio-chemical reactions. Certain intermediate compounds which formed as a result of oxidation of carbohydrates are utilized in the synthesis of oil and fats.

Effect of fertility levels on oil content and oil yield

Between two fertilizer levels 100% RDF recorded higher oil content than the lower dose, but the differences could not touch the level of significance. The higher oil content at 100% RDF may be attributed to improve nutrient availability particularly the sulphur and its role in oil synthesis and S containing amino acids, which are precursors for the biosynthesis of glucosinolates. The results are in agreement with the findings of Singh *et al.*, (2010). Furthermore sulphur is the constituent of a multi catalyst complex "fatty acid synthetase" that plays a paramount role in oil synthesis. The maximum oil yield was obtained with 100% RDF and it maintained distinct superiority over 75% RDF. The higher oil yield at higher rate of fertilizer application was probably due to higher seed yield. Comparable discoveries were accounted by Trivedi *et al.*, 2013^[15]. Sarangthem *et al.* (2008)^[12] also reported that addition of nitrogen significantly increased oil content in mustard seed.

Seed protein content of mustard significantly enhanced with higher fertility level as compared to 75% RDF (Table 1). As

nitrogen is the constituent for protein, increments in the fertiliser requisition habitually lead to increase in protein accumulation. (Malhi and Gill, 2007)^[7] Researchers have reported that application of N fertilisers enhanced the protein content at the expense of oil content (Rathke *et al.*, 2005)^[11]. In general, high protein content is correlated with low oil content and vice versa (Andersen *et al.* 1996)^[1]. The protein yield is the resultant impact of seed yield and protein content. Therefore, the higher protein yield with increasing at higher rate is justified. These discoveries are in agreement with those of Kachroo and Kumar (1999)^[5]; Singh *et al.* (2008)^[13].

Effect of cow urine levels on quality of mustard

Oil yield and Protein yield increased significantly with increasing levels of basal urine application up to 900 l urine ha⁻¹ (Table 1). As cow urine is known to promote the nitrogen uptake, higher levels of urine application resulted in increased seed protein content and protein yield in plants. Similar results were shown by Mohanty *et al.*, 2014^[9]. Both the protein and oil content of mustard seed improved with increasing levels of basal urine application up to 1200 l ha⁻¹. However, variation could not showed significant difference. The increase in oil content could be attributed due to the availability of nutrients particularly the sulphates, under the highest level of cow urine application (Ledgard *et al.*, 1982)^[6]. The role of sulphur in enhancing the oil content of oil seeds in general and mustard in particular is well documented by Kachroo and Kumar (1999)^[5]; Singh *et al.* (2008)^[13]. S fertilization increase the oil content as it has its role in oil synthesis (Tripathi *et al.*, 2010)^[14].

Effect of cow urine spray on quality of mustard

Oil yield and protein yield of mustard improved markedly with increasing application of foliar concentration urine. However, oil content and protein content could not showed significance difference to urine spray. The oil and protein content of seed was more in seedlings sprayed with higher concentration of cow urine as compared to the control. The biochemical contents (carbohydrates, protein, and amino acids) also enhanced with panchagavya spray. This conforms to the finding of Rajesh and Jayakumar (2013)^[10].

Effect of Fertility gradients and Basal and foliar spray Cow urine application on N, P, K contents of seed and stover

An examination of the data revealed 100% RDF have resulted significantly highest Nitrogen, phosphorus, potassium contents in seed and stover. However, the difference could not touch the level of significance in case of phosphorus content in seed between two fertility gradients. Provision of higher levels of fertilizers (NPKS) assured the adequate supply of nutrient which increased nitrogen, phosphorus and potassium content for their effective uptake leads to higher uptake and higher storage. The concentration of N, P and K were found more in seed than straw which showed the productive translocation of nutrients to the sink i.e. seed. This may be attributed to the higher NPKS content in seed and stover and consequently the higher biological yield. This also supports finding of Ghimire and Bana (2011)^[4] and Meena *et al.* (2013)^[8].

A critical study of the data revealed that basal application of cow urine increased the NPK content in seed and stover with increasing levels up to 1200 l urine ha⁻¹. However, the differences were significant only for N and K content of seed (Table 2). This shows higher utilization of cow urine by

mustard. Mohanty *et al.*, (2014) ^[9] also observed similar results.

Foliar application of cow urine markedly increased the N, P,

K content in seed and stover. However, the difference was significant only between spray of 50% urine and control for seed N and K contents.

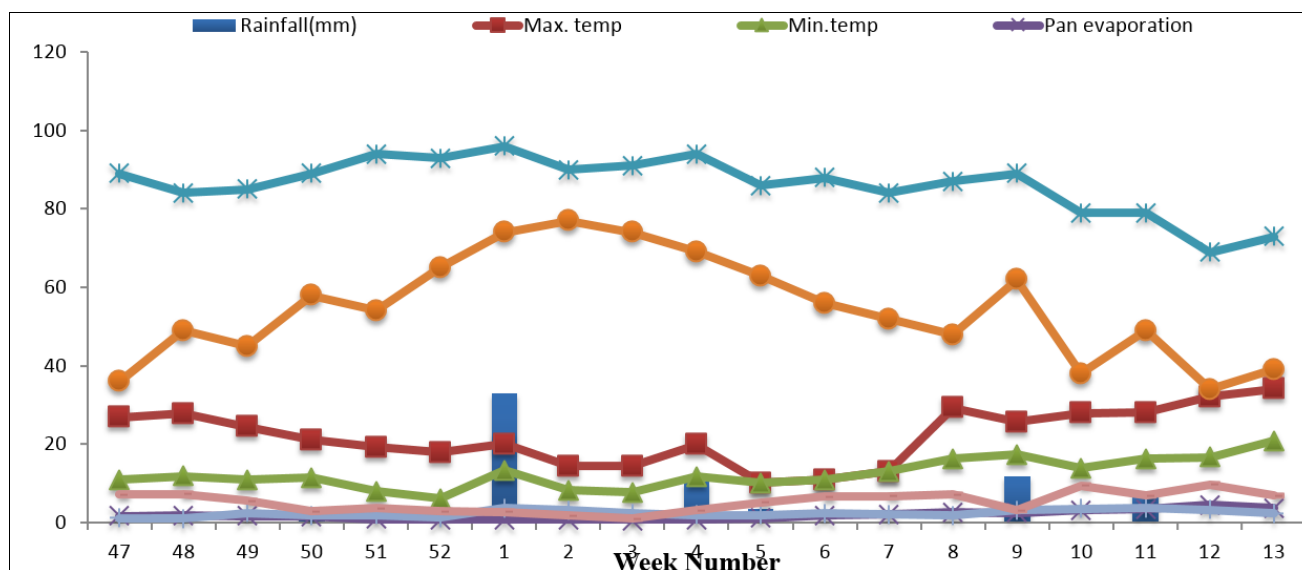


Fig 1: Standard Week wise metrological Observations recorded at Metrological Observatory, B.H.U. during the period of experimentation (2014-2015)

Table 1: Effect of fertility levels and cow urine application as basal and foliar spray on quality parameters of mustard

Treatment	Seed oil content (%)	Oil yield (kg ha ⁻¹)	Seed protein content (%)	Protein yield (kg ha ⁻¹)
Fertility levels				
75% RDF	35.7	404	20.6	232.3
100% RDF	36.0	468	21.0	272.4
S. Em _±	0.34	8.3	0.08	5.0
C.D. 5%	NS	26.2	0.25	15.6
Urine levels (l ha⁻¹)				
400	35.1	398	20.6	233.4
800	35.9	432	20.9	251.5
1200	36.6	478	20.8	272.3
S. Em _±	0.41	10.2	0.10	6.1
C.D. 5%	NS	32.1	NS	19.1
Urine spray				
Control	35.6	424	20.6	244.7
25%	35.8	431	20.8	250.6
50%	36.1	453	20.9	261.8
S. Em _±	0.53	8.5	0.14	3.4
C.D. 5%	NS	24.7	NS	10.0

Table 2: Effect of fertility levels and cow urine application as basal and foliar spray on N, P, K content (%) in seed and stover of mustard

Treatment	N content (%)		P content (%)		K content (%)	
	Seed	Stover	Seed	Stover	Seed	Stover
Fertility levels						
75% RDF	3.29	0.580	0.489	0.084	0.70	1.05
100% RDF	3.40	0.657	0.515	0.089	0.81	1.21
S. Em _±	0.01	0.018	0.010	0.001	0.022	0.037
C.D. 5%	0.05	0.058	NS	0.004	0.068	0.118
Urine levels (l ha⁻¹)						
400	3.32	0.575	0.479	0.084	0.70	1.05
800	3.32	0.644	0.511	0.087	0.77	1.16
1200	3.39	0.638	0.516	0.088	0.80	1.19
S. Em _±	0.02	0.022	0.012	0.002	0.026	0.046
C.D. 5%	0.06	NS	NS	NS	0.08	NS
Urine spray						
Control	3.32	0.602	0.490	0.084	0.73	1.10
25%	3.34	0.584	0.503	0.085	0.75	1.12
50%	3.37	0.669	0.514	0.089	0.79	1.18
S. Em _±	0.02	0.030	0.007	0.002	0.021	0.043
C.D. 5%	0.05	NS	NS	NS	0.06	NS

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