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Influence Of Cow Urine And NAA on Chemical, Biochemical And Yield Contributing Parameters And Yield Of Linseed

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ABSTRACT
The present investigation entitled, 'Influence of cow urine and NAA on chemical, biochemical and yield contributing parameters and yield of linseed was carried out during rabi 2016-17. Two foliar sprays of different concentrations of cow urine (4%, 6% and 8%) and NAA (25 ppm, 50ppm) were given at 35 and 55 DAS on linseed cultivar PKV-NL-260. The experiment was laid out in RBD with spacing of 30 cm × 5 cm at experimental farm of Botany section, College of Agriculture, Nagpur. Data revealed that foliar sprays of cow urine and NAA showed their significance over control. Treatment T_{10} (4% cow urine + 50 ppm NAA) followed by T_{11} (6% cow urine + 50ppm NAA) significantly increased chlorophyll content in leaves, leaf nitrogen content, leaf phosphorus content, leaf potassium content, oil content in seed, number of capsules plant^{-1}, number of seeds capsules^{-1}, test weight, seed yield plant^{-1} (g) and seed yield plot^{-1} (kg). When compared with control and other treatments under study.
Key words: Linseed, cow urine, NAA, chemical and biochemical parameters and yield

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INTRODUCTION
Linseed is rich source of nutrient like fat, protein, and dietary fibre. An analysis of brown Canadian linseed contains 41% fat, 20% protein, 28% total dietary fibre (Morris, 2003). Recent advances in medical research have found linseed as a best herbal source of Omega-3 and Omega-6 fatty acids which have immense nutritional/medicinal effects on human body system. Linseed contains 57% 18:3 Omega-3 fatty acid (mostly ALA) and 16% 18:2 Omega-6 fatty acid.
Linseed oil contains 53% 18:3 Omega-3 fatty acid (mostly ALA) and 13% 18:2 Omega-6 fatty acid. (Morris, 2003). Linseed stem yields good quality of fibre having strength and durability. The fibre is lustrous and blends very well with wool, cotton, silk, etc.
Cow urine is having nutrients like N 1%, K_2O 1.9% and P_2O_5 in traces (Tamhane *et al.*, 1965). NAA is synthetic auxin with identical properties to that of naturally occurring auxin i.e., IAA in plant. Auxin in low concentration promotes cell elongation i.e., growth, but in higher concentration it inhibits the growth.
If we consider the world scenario of linseed production, India is far behind in productivity. The increase in production of linseed is only being possible due to increase in area under crop and by applying growth promoting substances like cow urine and NAA.
Considering the above facts present investigation was undertaken to study the effect of cow urine and NAA on chemical, biochemical and yield contributing parameters and yield of linseed.

MATERIALS AND METHODS
The field experiment was laid out in Randomized Block Design (RBD) with three replications consisting of twelve treatments comprising of different doses of cow urine (4%, 6% and 8%) and NAA (25 ppm, 50 ppm). Seeds were sown at the rate of 25 kg ha^{-1} by drilling method at a spacing of 30 cm x 5 cm. Data were recorded total chlorophyll content, leaf nitrogen content, leaf potassium content at 35, 55 and 75 DAS and oil content were recorded. Number of capsules plant^{-1}, number of seed capsules^{-1} and test weight ratio were also recorded and calculated. The analysis of variance was performed to test the significance of

differences between the treatment for all the characters as per the methodology suggested by Panse and Sukhatme (1954).

RESULTS AND DISCUSSION

Chlorophyll content in leaves

Chlorophyll is the green pigment present in leaf and playing main role in the photosynthetic activity and thereby increasing the weight of the plant.

The increase in the chlorophyll content in leaves was found upto 55 DAS but thereafter, it decreased. Data regarding chlorophyll content in leaves at 35 DAS was found to be non significant.

At the 55 DAS the highest chlorophyll content was recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by 6% cow urine + 50 ppm NAA (T_{11}) and 8% cow urine +50 ppm NAA (T_{12}). But treatments 6% cow urine + 25 ppm NAA (T_8), 4% cow urine + 25 ppm NAA (T_7), 8% cow urine +25 ppm NAA (T_9) 50 ppm NAA (T_6), 25 ppm NAA (T_5) , 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control.

At 75 DAS chlorophyll content in leaves ranged from 1.36-2.72 mg g^{-1}. Significantly highest chlorophyll was found in combination treatment of 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}) and 8% cow urine +50 ppm NAA (T_{12}). It was also found that the treatment 6% cow urine + 25 ppm NAA (T_8) and 4% cow urine + 25 ppm NAA (T_7) also increased chlorophyll content over control and remaining treatments.

The green leaf pigment chlorophyll which enables plants to use the energy of sunlight to form sugars from carbon dioxide and water and is a nitrogenous compound. A high concentration of N is found in young tender plant tissues like tips of shoots and new leaves. The N present mostly as protein, is constantly moving and under going chemical changes. The foliar application of cow urine gave these additional nutrients to crop and this might have accelerated chlorophyll synthesis. Application of growth hormones like IAA, NAA also accelerates the uptake of nutrients in groundnut (Sagare and Naphade, 1987).

Rajesh and Reddy (2014) tried two growth promoting substances i.e. [NAA (20 ppm) and Brassinosteriod (20 ppm)] and two growth retarding substances [Chlormequatchloride (50% SL) and Mepiquatchloride (5% AS (5%)] on green gram. These growth regulators were sprayed at flower initiating stage .Chlorophyll content values were significantly highest in chlormequat chloride 50 % SL 375.0 g a.i. ha^{-1}, mepiquat chloride 5% AS (5%) and NAA (20 ppm) during this stage of observation.

Singh *et al*. (2015) concluded that foliar application of 50 ppm NAA recorded significantly increased leaf chlorophyll content in fenugreek. Upaydhyay and Rajan (2015) tested different concentrations of growth regulators (T_1-control, T_2-NAA-10 ppm, T_3-NAA 20 ppm, T_4-NAA 30 ppm, T_5-GA_3-10 ppm, T_6-GA_3-20 ppm, T_7- GA_3-30 ppm, T_8-Kinetin-10 ppm, T_9-Kinetin-20 ppm, T_{10}-Kinetin-30 ppm) on soybean. They observed significantly more chlorophyll content by the application of 20 ppm NAA followed by GA_3.

Leaf nitrogen content

Nitrogen is the important constituent of protein and protoplasm and essential for plant growth. Nitrogen deficiency causes chlorosis and malfunctioning of the photosynthesis process. Plant cells require adequate supply of N for normal cell division and growth of the plant. Tender shoots, tips of shoots, buds, leaves contains higher nitrogen content.

It is observed from the data that there was significant variation in leaf nitrogen due to foliar sprays of cow urine at various concentrations and growth hormone at 55 and 75 DAS.

Leaf nitrogen was non significanty enhanced by different treatments of cow urine and NAA at 1st stage of observation (35 DAS). Leaf nitrogen at 55 DAS was significantly enhanced by the treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8) and 4% cow urine + 25 ppm NAA (T_7) over control and rest of treatments in a descending manner.

Leaf nitrogen at 75 DAS was highest in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8), 4% cow urine + 25 ppm NAA (T_7) and 8% cow urine +25 ppm NAA (T_9) over control and rest of treatments in a descending manner.

From this data it is observed that leaf nitrogen content was increased upto 55 DAS and reduced thereafter, at different stages of observations. The decrease in nitrogen content might be due to fact that younger leaves and developing organs, such as seeds act as strong sink demand and may draw heavily nitrogen from older leaves, (Gardner *et al*., 1988).

At the vegetative period, physiological and metabolic activities are at higher rate and this might be the reason for increase in uptake of nitrogen content from soil at early stages of crop growth. Decrease in nitrogen content might be due to translocation and utilization of nutrients for flower and capsules formation. Foliar application of cow urine with growth hormone also accelerates the uptake of all micro and macro nutrients (Sagare and Naphade, 1987).

Deogirkar (2010) investigated the effect of foliar sprays of cow urine (4, 6, 8 and 10%) and NAA (0.36, 0.55, 1.03 and 2.31 ppm) on the chemical and biochemical parameters of chickpea cv.Jaki. The results showed that foliar sprays of 6% cow urine was found most effective in increasing nitrogen content in leaves over control. Singh *et al*. (2015) revealed that foliar application of 50 ppm NAA significantly increased leaf nitrogen content in fenugreek.

Leaf phosphorus content

Data showed significance at all the stages of observations viz., 55 and 75 DAS except 35 DAS stage. At 55 DAS treatment 4% cow urine + 50 ppm NAA (T_{10}), was showed highest phosphorus content followed by treatments 6% cow urine + 50 ppm NAA (T_{11}) and 8% cow urine +50 ppm NAA (T_{12}) over control and rest of the treatments. It was also noticed that the treatments 6% cow urine + 25 ppm NAA (T_8), 4% cow urine + 25 ppm NAA (T_7), 8% cow urine +25 ppm NAA (T_9), 50 ppm NAA (T_6) and 25 ppm NAA (T_5) also increased leaf phosphorus content over control and remaining treatments.

At 75 DAS treatment 4% cow urine + 50 ppm NAA (T_{10}) was showed significantly highest phosphorus content followed by treatments 6% cow urine + 50 ppm NAA (T_{11}) and 8% cow urine +50 ppm NAA (T_{12}) over control and rest of the treatments. Moreover, treatments 6% cow urine + 25 ppm NAA (T_8), 4% cow urine + 25 ppm NAA (T_7), 8% cow urine +25 ppm NAA (T_9), 50 ppm NAA (T_6) and 25 ppm NAA (T_5) also recorded significantly more leaf phosphorus content over control and rest of the treatments.

Similarly the application of growth hormones enhances the uptake of nutrients from soil and also increased physiological and metabolic activities of plant cell (Sagare and Nephade 1987). These might have another reasons for increase in phosphorus content in leaves in present study.

It was known that growth hormone increases the uptake of nutrients from soil and also increases metabolic activities in the plant cell (Sagare and Naphade, 1987).

Deogirkar (2010) applied cow urine (4, 6, 8 and 10%) and NAA (0.36, 0.55, 1.03 and 2.31 ppm) on chickpea cv.Jaki. The results showed that foliar sprays of 6% cow urine was found most effective in increasing phosphorus content in leaves over control.

Singh *et al*. (2015) carried out an experiment to study the effect of foliar application of 50 ppm NAA on fenugreek and found significantly maximum leaf phosphorus content.

Leaf potassium content

Data were subjected to statistical analysis and were found significant at 55 and 75 DAS stages. Potassium content at 35 DAS by the application of different treatments were found non significant.

Potassium content at 55 DAS was found significantly more in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}) and 6% cow urine + 25 ppm NAA (T_8) over control and other treatments under study.

Potassium content at 75 DAS was significantly maximum in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8) and 4% cow urine + 25 ppm NAA (T_7) in a descending manner when compared with control and remaining treatments under study.

It was observed that potassium content increased upto 55 DAS but thereafter, at 75 DAS stage it was decreased. The decreasing potassium content might be due to diversion of potassium towards developing capsules of linseed.

It is observed from the data that the application of cow urine at various concentrations combined with hormone NAA at 50 ppm gave significantly more leaf potassium content when compared with the individual foliar sprays of either cow urine or NAA but all the individual sprays of cow urine at various concentrations and 50 ppm NAA were also found significantly superior over control.

In young stage plant may be able to uptake nutrient more readily than the older one. Potassium in leaf tissues was found higher at second stage of observation, mainly due to application of cow urine and NAA and it might be because of relatively higher physiological activities as the plant tissues were younger during this stage. At the third stage of observation potassium content in leaves decreased, which might be because of translocation of leaf potassium and its utilization for the development of food storage organs.

Arsode (2013) recorded enhancement in potassium content in mustard by the application of 50 ppm NAA + 300 ppm HA through cowdung wash. Singh *et al*. (2015) showed that foliar application of 50 ppm NAA significantly increased leaf potassium content in fenugreek.

Oil content in seed

Linseed is mainly known as oilseed crop. Although quality of crop products such as oil, protein and sucrose content and appearance is genetically controlled, nutrition of plants can have considerable impact on the expression of quality. It is therefore, essential to judiciously take care on the nutrient supply at grain formation stage. Oil content of seed is one of the considerable factors for seed quality determinations also.

Data showed significant variation by the application of cow urine and NAA. The range of oil content in seed was 35.30-41.17%. Significantly maximum seed oil was recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}) , 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8) and 4% cow urine + 25 ppm NAA (T_7) when compared with control and rest of the treatments under study.

The increase in oil content of seed by the application of NAA might be due to increase in synthesis or activation of both the lypolitic enzymes. Increased oil content is a consequence of more synthesis of amino acid and increased conversion of carbohydrates to oil. Foliar application of NAA increases the uptake and availability of nutrients and its further assimilation for biosynthesis of oil. These might be the reasons for increased oil content in seed in the present investigation.

Pawar *et al.* (2008) found increase in oil content in kernel of groundnut by the application of 4% cow urine + 50 ppm NAA. Arsode (2013) stated that application 50 ppm NAA + 300 ppm HA through cowdung wash significantly increased oil per cent in mustard.

Seed yield

Seed yield is the economic yield which is final result of physiological activities of plant. Economic yield is the part of biomass that is converted into economic product. (Nichiporovic, 1960).

Source–sink relation contributes to the seed / grain yield. It includes phloem loading at source (leaf) and unloading at sink (seed and capsule) by which the economic part will be getting the assimilates synthesized by photosynthesis. Partitioning of the assimilate in the plant during reproductive development is important for flower, capsule and seeds. Thus, crop yield can be increased either by increasing the total dry matter production or by increasing the proportion of economic yield (harvest index) or both (Gardner *et al*., 1988).

The maximum seed yield hectare^{-1} was recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}). The range of increase in seed yield hectare^{-1} was 11.99 q in treatment T_1 (control) to 15.99 q in treatment 4% cow urine + 50 ppm NAA (T_{10}).

Significantly maximum seed yield ha^{-1} was recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}) and 6% cow urine + 25 ppm NAA (T_8) in a descending manner when compared with control and rest of the treatments. The above data gives clear view that the combination effect of cow urine and NAA assures significantly better results. As these treatments were given through foliar sprays, observed superiority might be due to foliar feeding of major nutrients like N, P, K to plants through cow urine and altered metabolic activities due to hormone NAA. When nutrients required by plants are applied through foliage, there is enhancement in uptake, translocation and synthesis of photosynthetic assimilates.

Rajesh and Reddy (2014) carried out an experiment to study the influence of different growth regulating compounds on physiological aspect in greengram. Sparying of two growth promoting substances [NAA (20 ppm) and Brassinosteriod (20 ppm)] and two growth retarding substances [Chlormequatchloride (50% SL) and Mepiquatchloride (5% AS (5%)] was done at flowering stage. The 100 seed weight and seed yield increased significantly with NAA (20 ppm) followed by mepiquat chloride 5% AS, brassinosteroid (20 ppm), chloromequat chloride (137.5.5 ai ha^{-1}).

Harvest index (HI)

Significantly maximum harvest index was recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}) and minimum in control. The range of increased harvest index was 40.45 in control and 46.96 in above treatment.

Treatment 4% cow urine + 50 ppm NAA (T_{10}) showed the maximum harvest index followed by treatments 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}) and 6% cow urine + 25 ppm NAA (T_8) increased harvest index significantly over control and rest of the treatments. It was also noticed that the treatments 4% cow urine + 25 ppm NAA (T_7), 8% cow urine + 25 ppm NAA (T_9), 50 ppm NAA (T_6), 25 ppm NAA (T_5) and 8% cow urine (T_4) also increased harvest index over control and remaining treatments. Treatments 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1) in respect of harvest index.

Ingle (2007) found increase in harvest index with foliar spray of 6 % cow urine + 50 ppm NAA in black gram. Shinde and Jadhav (1994) found increase in harvest index of pigeonpea with the foliar spray of 40 ppm IBA followed and 40 ppm NAA. Madrap *et al.* (1992) reported highest biological yield and harvest index with foliar spray of 100 and 50 ppm IAA spray in safflower.

Harvest index is the proportion of biological yield represented by economic yield. It is the coefficient of effectiveness or the migration coefficient. Harvest index reflects the proportion of assimilate distribution between the economic yield and total biomass (Donald and Hamblin, 1976). Increase in harvest index might be the result of coordinated interplay of growth and development characters.

The analysis of B:C ratio due to expenditure incurred under different treatments of cow urine and NAA revealed that highest benefit: cost ratio for treatment 4% cow urine + 50 ppm NAA (T_{10}) was calculated 5.36 as compared to 4.13 for control (T_1).

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Table 1. Effect cow urine and NAA on chemical and biochemical parameters of linseed

Treatments	Leaf chlorophyll content (mg g^{-1})			Leaf nitrogen content (%)			Leaf phosphorus content (%)			Leaf potassium content (%)			Seed oi content
T_1 (control)	**35 DAS**	**55 DAS**	**75 DAS**	**35 DAS**	**55 DAS**	**75 DAS**	**35 DAS**	**55 DAS**	**75 DAS**	**35 DAS**	**55 DAS**	**75 DAS**	35.30
T_2 (4% cow urine)	1.05	1.82	1.36	0.81	0.86	0.81	0.101	0.135	0.104	0.261	0.321	0.221	35.81
T_3 (6% cow urine)	1.07	1.85	1.38	0.87	0.89	0.82	0.132	0.141	0.118	0.252	0.350	0.232	36.56
T_4 (8% cow urine)	1.10	1.86	1.40	0.90	0.92	0.87	0.114	0.158	0.131	0.251	0.361	0.251	36.87
T_5 (25 ppm NAA)	1.04	1.86	1.43	0.80	0.93	0.89	0.121	0.172	0.142	0.280	0.372	0.284	37.22
T_6 (50 ppm NAA)	1.09	1.88	1.49	0.80	0.95	0.89	0.103	0.174	0.157	0.241	0.393	0.291	37.69
T_7 (4% cow urine +25 ppm NAA)	1.13	1.89	1.52	0.79	0.97	0.94	0.126	0.180	0.173	0.272	0.414	0.312	39.04
T_8 (6% cow urine +25 ppm NAA)	1.06	1.96	1.89	0.81	1.03	0.98	0.121	0.224	0.182	0.254	0.452	0.373	39.48
T_9 (8% cow urine + 25 ppm NAA)	1.08	2.32	2.12	0.82	1.05	0.99	0.112	0.244	0.226	0.262	0.482	0.387	38.51
T_{10} (4% cow urine +50 ppm NAA)	1.02	1.93	1.74	0.85	1.01	0.97	0.101	0.200	0.179	0.294	0.431	0.340	41.17
T_{11} (6% cow urine +50 ppm NAA)	1.07	2.72	2.68	0.84	1.10	1.03	0.110	0.282	0.251	0.240	0.549	0.461	40.75
T_{12} (8% cow urine + 50 ppm NAA)	1.05	2.57	2.46	0.86	1.09	1.01	0.109	0.263	0.249	0.261	0.520	0.433	40.32
S E (m)±	1.12	2.39	2.37	0.80	1.07	1.01	0.108	0.254	0.231	0.282	0.491	0.414	0.860
C D at 5%	0.076	0.119	0.101	0.054	0.043	0.042	0.009	0.011	0.008	0.02	0.027	0.021	2.574
	-	0.355	0.302	-	0.128	0.125	-	0.032	0.023	-	0.080	0.062	

Table 2. Effect cow urine and NAA on yield contributing parameters of linseed.

Treatments	Seed yield ha^{-1} (q)	B:C ratio	Harvest Index (%)
T_1 (control)	11.99	4.13	40.45
T_2 (4% cow urine)	12.16	4.35	41.48
T_3 (6% cow urine)	12.73	4.37	42.53
T_4 (8% cow urine)	12.99	4.45	42.86
T_5 (25 ppm NAA)	13.39	4.55	43.55
T_6 (50 ppm NAA)	13.59	4.57	44.41
T_7 (4% cow urine +25 ppm NAA)	14.01	4.75	45.25
T_8 (6% cow urine +25 ppm NAA)	14.66	4.97	45.67
T_9 (8% cow urine + 25 ppm NAA)	13.66	4.62	44.79
T_{10} (4% cow urine +50 ppm NAA)	15.99	5.36	46.96
T_{11} (6% cow urine +50 ppm NAA)	15.33	5.13	46.51
T_{12} (8% cow urine + 50 ppm NAA)	14.93	4.99	45.92
SE (m)±	0.671	-	0.430
CD at 5%	2.010	-	1.287

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