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EFFICACY OF COW URINE AND NAA ON CHEMICAL, BIOCHEMICAL ANDYIELD AND YIELD CONTRIBUTING PARAMETERS OF WHEAT

R. D. Deotale[1],S. B. Korade[2],V. A. Guddhe[3],N. D. Jadhav[4] and O. G. Thakare[5]

ABSTRACT

The experiment was conducted to study the effect of two foliar sprays of different concentrations of NAA (25, 50 ppm) and cow urine (4%, 6%, 8%, 10%) at 45 and 60 DAS on wheat cultivar AKW-3722. The experiment was laid out in RBD with spacing of 20 cm in *rabi* 2017-2018. Observations on chemical (N, P, K) and biochemical (chlorophyll) parameters were recorded at 25, 40, 55 and 75 DAS and protein content in grain was recorded after harvesting. Observations on 1000 grain weight, number of spikelets ear^{-1}, number of grains ear^{-1}, grain weight ear^{-1}, seed yield plant^{-1}, seed yield plot^{-1} and ha^{-1}was also recorded at harvesting. Considering the concentrations 10% cow urine with 25 ppm NAA was found more effective in enhancing the chemical, biochemical, yield and yield contributing parameters when compared with control.

(Key words : Wheat, cow urine, NAA, foliar application, biochemical parameters and yield)

INTRODUCTION

Wheat is (*Triticum* spp.) is an annual plant of gramineae family. It is most widely cultivated as stable food crop of the world. It is cultivated extensively in North Western and Central zones. North West India along with Afganistan probably forms the centre of origin of bread wheat and India is one of the ancestral land of this essential food crop. The top ten wheat producing countries are China, India, United State, France, Russia, Australia, Canada, Pakistan, Germany and Turkey.

Wheat is nutritionally important as it contains protein-28%, fat-3%, total carbohydrates-23%, potassium-12%, sodium-nil, cholesterol-nil. It is a major source of energy in human diet. Wheat grain also contains thiamine, riboflavin, niacin and small amount of vitamin A, but the milling processes remove the bran and germ where these vitamins found in abundance.

Wheat straw is having the multiple uses as it can be used as animal feed, in basketry, bedding purpose for livestock, biofuel, biomass etc.and wheat endosperm is also very essential because it contains oil and protein. Globally wheat is the leading source of protein in human food because it contains higher protein than other major cereals. Wheat is staple food used to make flour for making chapati,steamed breads, biscuits, cookies, cakes, pasta, noodles and fermentation to make beer and other alcoholic beverages.

Wheat is planned to limited extent as a forage crop for livestock and it's straw can be used as a construction material for roofing thach.

Considering the above facts present investigation was undertaken to study the effect of cow urine and NAA on chemical, biochemical, yield and yield contributing parameters of wheat.

MATERIALS AND METHODS

A field experiment was conducted at Botany farm, College of Agriculture, Nagpur to know the response of wheat to growth regulators on its biochemical and yield contributing parameters.The experiment was laid out in complete randomized block design with three replications. The experiment consisted of fifteen treatments viz., cow urine (4, 6, 8, 10 %) and NAA (25, 50 ppm) alone and in a combination on chemical, biochemical, yield and yield contributing parameters of wheat cultivar AKW-3722. The seeds were sown with a spacing of 20 cm. Cow urine and NAA were sprayed twice at 45 and 60 DAS.First two observations (25 DAS and 40 DAS) were taken before the spray and other observations were taken at 55 and 75 DAS. Five randomly selected plants were tagged and observations weretaken on chemical and biochemical parameters (leaf chlorophyll content, N, P, K content in leaves and protein content) and yield attributing characters (1000 grain weight,number of spikelets ear^{-1}, number of grains ear^{-1}, grain weight ear^{-1}, seed yield plant^{-1}, seed yield plot^{-1} and ha^{-1}). Determination of nitrogen and protein was carried out by micro-kjeldhal method given by Somichi *et al.* (1972). Phosphorus and potassium were estimated by vanadomolybdate yellow colour method, using calorimeter as given by Jackson (1967). The observed data were analyzed

1. Professor, Botany Section, College of Agriculture, Nagpur
2, 3, 4 and 5. P.G. Students, Botany Section, College of Agriculture, Nagpur

statistically using analysis of variance at 5% level of significance (Panse and Sukhamate, 1954).

RESULTS AND DISCUSSION

Chlorophyll content

The chlorophyll content differed significantly between control, cow urine and NAA applied plants (Table 1). Data on leaf chlorophyll content at 25-40 DAS were found non-significant because spraying of cow urine and NAA was given at 45-60 DAS.

At 55 DAS chlorophyll content in leaves ranged from 1.4-1.7 mg g^{-1}. Significantly highest chlorophyll was found in combination treatments of 10% cow urine + 25 ppm NAA (T_{11}), 8% cow urine + 25 ppm NAA (T_{10}) and 6% cow urine + 25 ppm NAA (T_9) when compared with control and rest of the treatments. Foliar application of 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4) and 6% cow urine (T_3) also enhanced chlorophyll content at this stage of observation over treatments 4% cow urine (T_2) and control (T_1).

At 75 DAS chlorophyll content in leaves ranged from 1.47-1.84 mg g^{-1}. Significantly maximum leaf chlorophyll was noticed in combination treatments of 10% cow urine + 25 ppm NAA (T_{11}), 8% cow urine + 25 ppm NAA (T_{10}) and 6% cow urine + 25 ppm NAA (T_9) when compared with control and rest of the treatments. Significantly moderate to minimum chlorophyll content in leaves was noticed in treatments 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) in a descending manner over control (T_1).

It is obvious from the data that chlorophyll content in leaves was maximum at 55-75 DAS. Nitrogen is a constituent element in chlorophyll which rapidly increases at vegetative stage. As the nitrogen reserves are in ample quantity at this stage. However, rate of nitrogen mobilization is more to the reproductive part than the rate of nitrogen uptake. Hence, increase in chlorophyll content during 55-75 DAS might be due to increased uptake of N, P, K and other nutrients in early stage of plant growth.

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).

Upaydhyay and Rajan (2015) applied different concentrations of growth regulators (T1-control, T2-NAA-10 ppm, T3-NAA 20 ppm, T4-NAA 30 ppm, T5- GA_3-10 ppm, T6- GA_3-20 ppm, T7- GA_3-30 ppm, T8-Kinetin-10 ppm, T9-Kinetin-20 ppm, T10-Kinetin-30 ppm) on soybean. The significantly maximum chlorophyll content was observed in kinetin 20 ppm followed by NAA and GA_3.

Chute (2017) reported that foliar application of 4% cow urine + 25 ppm NAA at 35 and 55 DAS significantly enhanced chlorophyll content in leaves of linseed.

Nitrogen content

It is observed from data that there was significant variation in leaf N content due to foliar sprays of cow urine and NAA at various concentrations at 55 and 75 DAS.

At 55 DAS N content in leaves ranged from 1.32-1.74 %. Treatments 10% cow urine + 25 ppm NAA (T_{11}), 8% cow urine + 25 ppm NAA (T_{10}) and 6% cow urine + 25 ppm NAA (T_9) gave significantly maximum N content followed by treatments 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5) and 8% cow urine (T_4) in descending manner when compared with control (T_1)

At 75 DAS N content in leaves ranged from 0.46-0.77%. Significantly highest N content was recorded in treatments 10% cow urine + 25 ppm NAA (T_{11}), 8% cow urine + 25 ppm NAA (T_{10}) and 6% cow urine + 25 ppm NAA (T_9) when compared with control and rest of the treatments. Whereas treatments 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4) and 6% cow urine (T_3) also showed significantly more nitrogen content over control and treatment 4% cow urine (T_2).

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 grain formation. Foliar application of cow urine with growth hormone also accelerates the uptake of all micro and macro nutrients (Sagare and Naphade, 1987).

Chute (2017) noted maximum values of nitrogen content in leaves by the foliar application of 4% cow urine + 25 ppm NAA at 35 and 55 DAS in linseed.

Deotale *et al.* (2017) reported that two foliar sprays of 6% cow urine + 50 ppm NAA alone and in combination given at 45 and 65 DAS significantly increased nitrogen content in leaves of pigeon pea.

Phosphorous content

Data showed non-significant variation at the stages of observations i.e 25, 40 DAS, and showed significant variation at the stages of 55 and 75 DAS because spraying of cow urine and NAA was done at 45 and 60 DAS.

At 55 DAS P content in leaves ranged from 0.30-0.62 %. Significantly maximum P content was recorded in treatments 10% cow urine + 25 ppm NAA (T_{11}) and 8% cow urine + 25 ppm NAA (T_{10}) over control and rest of the treatments. Treatments 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA (T_7), 10% cow urine (T_5), 8% cow urine (T_4) and 6% cow urine (T_3) also increased phosphorus content significantly over treatments 4% cow urine (T_2) and control (T_1).

At 75 DAS treatments 10% cow urine + 25 ppm NAA (T_{11}) and 8% cow urine + 25 ppm NAA (T_{10}) followed by treatments 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA (T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA (T_7), 10% cow urine (T_5) and 8% cow urine (T_4) significantly increased leaf phosphorus content when compared with control and remaining treatments under study. Treatments 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1) in phosphorus content in leaves.

It is evidence from data that P content gradually decreased from 55-75 DAS. It might be because of translocation of leaf P and its utilization for development of food storage organs.

Increase in phosphorus content might be due to supply of phosphorus to the plant through application of cow urine. 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 Naphade, 1987). These might have another reasons for increase in phosphorus content in leaves in present study.

Chute (2017) stated that two foliar sprays of 4% + 50 ppm NAA at 35 and 55 DAS significantly enhanced phosphorus content in leaves of linseed.

Deotale *et al.* (2017) stated that two foliar sprays of 6% cow urine + 50 ppm NAA alone and in combination given at 45 and 65 DAS significantly increased phosphorus in leaves of pigeon pea.

Potassium content

Data were subjected to statistical analysis and were found non-significant at 25 and 40 DAS stages of observations and significant at 55-75. Because spraying of cow urine and NAA was done at 45 and 60 DAS stage.

At 55-75 DAS K content in leaves ranged from 0.49-0.79 % and 0.38-0.69 % respectively. Treatments 10% cow urine + 25 ppm NAA (T_{11}) and 8% cow urine + 25 ppm NAA (T_{10}) gave significantly maximum leaf K content over control and rest of the treatment under study. Similarly application of 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA (T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4) and 6% cow urine (T_3) also increased leaf potassium content significantly when compared with control except treatments 4% cow urine (T_2).

It is observed from the data that the application of cow urine at various concentrations combined with hormone NAA at 25 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 25 ppm NAA were also found significantly superior over control except 4% cow urine spray.

In young stage plant may be able to uptake nutrient more readily than the older one. Potassium in leaf tissues was found higher at third 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 fourth 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.

Deogirkar (2010) studied 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 spray of 6% cow urine was found most effective in increasing potassium content in leaf over control and rest of the treatments under study.

Chute (2017) tried three concentrations of cow urine (4, 6, 8%) and two concentrations of NAA (25 and 50 ppm) on linseed and noticed that foliar application of 4% cow urine and 50 ppm NAA significantly enhanced potassium content in leaves.

Protein content

The range of protein content in seed was 12.14% in control (T_1) and 13.50% in treatment receiving 10% cow urine + 25 ppm NAA (T_{11}). Protein content was found significantly highest in this treatment. Next to this treatment in a descending manner treatments were 8% cow urine + 25 ppm NAA (T_{10}), 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA (T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA (T_7), 10% cow urine (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2). These all treatments were also found significantly superior over control in protein content in seed.

N is the constituent of protein hence, increase in N content ultimately resulted in increase in protein content in grains of wheat in the present investigation.

Major part of N is accumulated in the seed during grain filling stage. Nitrogen is key component in mineral fertilizers and has more influence on plant growth, appearance and fruit production / quality than any other element. It affects the absorption and distribution of other essential elements. Foliar application of cow urine and NAA increases the uptake and availability of nutrients and its further assimilation for biosynthesis of protein. This might be the reasons for increased protein content in seed in the present investigation.

The mode of action of cow urine on plant growth can be divided into direct and indirect effects as it affects the membranes resulting in improved transport of nutritional elements, enhanced photosynthesis, solubilization of micro nutrients which ultimately enhances the protein synthesis.

Singh *et al.* (2015) reported significant increase in protein content in seed of fenugreek by foliar application of 15 ppm NAA.

Deotale *et al.* (2017) reported that two foliar sprays of 6% cow urine + 50 ppm NAA given at 45 and 65 DAS significantly increased protein content in seeds of pigeonpea.

Yield and yield contributing parameters

1000 grain weight

Data showed significant variation in 1000 grain weight. The highest 1000 grain weight (45.9 g) and the lowest 1000 grain weight (41.76 g) were recorded in treatment receiving 10% cow urine + 25 ppm NAA (T_{11}) and control (T_1) respectively. However, 1000 grain weight was significantly maximum in treatments receiving 10% cow urine + 25 ppm NAA (T11), 8% cow urine + 25 ppm NAA (T_{10}), 6% cow urine + 25 ppm NAA (T_9) and 4% cow urine + 25 ppm NAA (T_8) over control and rest of the treatments. Foliar application of 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA (T_7) and 10% cow urine (T_5) also enhanced 1000 grain weight over treatments 8% cow urine (T_4), 6% cow urine (T_3), 4% cow urine (T_2) and T_1 (control).

Chute *et al.* (2017) applied different concentrations of cow urine (4, 6, 8%) and NAA (25 and 50 ppm) alone and in combination and found that foliar application 4% cow urine + 50 ppm NAA at 35 and 55 DAS significantly enhanced 1000 seed weight in linseed.

Deotale *et al.* (2017) reported that two foliar sprays of 6% cow urine + 50 ppm NAA given at 45 and 65 DAS significantly increased 1000 grain weight of pigeonpea.

Number of spikelets ear^{-1}

Treatments 10% cow urine + 25 ppm NAA (T_{11}) and 8% cow urine + 25 ppm NAA (T_{10}) gave significantly highest number of spikelets ear^{-1}. Treatments 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA(T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) also exhibited more number of spikelets ear^{-1} significantly as compared to control.

Number of grains ear^{-1}

Number of grains ear^{-1} increased significantly in treatments 10% cow urine + 25 ppm NAA (T_{11}), 8% cow urine + 25 ppm NAA (T_{10}) and the 6% cow urine + 25 ppm NAA (T_9) over control and rest of the treatments. Application of 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5) and 8% cow urine (T_4) also recorded significantly more number of grains ear $^{-1}$ over control and rest of the treatments. Application of 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control in number of grains ear^{-1}.

Grain weight ear^{-1}

The grain weight ear^{-1} found significantly highest in treatment 10% cow urine + 25 ppm NAA (T_{11}). Treatments 8% cow urine + 25 ppm NAA (T_{10}), 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA(T_8), 25 ppm NAA(T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA(T_7), 10% cow urine (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) also enhanced grain weight ear^{-1} over treatment T_1 (control).

Seed yield plant^{-1}

Seed yield plant^{-1} varied among the treatments and ranged a minimum of 6.25 to a maximum of 7.33. Among all the treatments the highest seed yield plant^{-1} was obtained in treatment 10% cow urine + 25 ppm NAA (T_{11}) followed by treatments 8% cow urine + 25 ppm NAA (T_{10}), 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA (T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA (T_7) and 10% cow urine (T_5) when compared with treatment T_1 (control) and rest of the treatments under observations. Foliar application of 8% cow urine (T_4), 6% cow urine (T_3), 4% cow urine (T_2) exhibited significantly minimum seed yield plant^{-1} and remained at par with control treatment.

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 the 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 which results into increase in various chemical, biochemical and yield contributing parameters. These might be the reasons responsible for spectacular increase in overall seed yield in wheat.

Chute *et al*. (2017) observed that two foliar sprays of 4% cow urine + 50 ppm NAA at 35 and 55 DAS significantly increased seed yield plant^{-1}, plot^{-1}, and ha^{-1}.

Deotale *et al*. (2017) reported that two foliar sprays of 6% cow urine + 50 ppm NAA given at 45 and 65 DAS significantly increase yield and yield contributing parameters of pigeonpea.

Table 1. Effect of cow urine and NAA on leaf chlorophyll, nitrogen and phosphorus content in leaves

Treatments	Chlorophyll content in leaves (mg ^{1})				Nitrogen content in leaves (%)				Phosphorous content in leaves (%)				Potassium content in leaves (%)			
	25 DAS	40 DAS	55 DAS	75 DAS	25 DAS	40 DAS	55 DAS	75 DAS	25 DAS	40 DAS	55 DAS	75 DAS	25 DAS	40 DAS	55 DAS	75 DAS
T1 (Control)	0.70	1.07	1.40	1.47	0.42	0.85	1.32	0.46	0.15	0.21	0.30	0.23	0.25	0.30	0.49	0.38
T2 (4% cow urine)	0.72	1.23	1.42	1.55	0.44	0.90	1.33	0.49	0.18	0.23	0.32	0.25	0.28	0.32	0.51	0.40
T3 (6% cow urine)	0.74	1.25	1.45	1.56	0.45	0.95	1.35	0.50	0.17	0.24	0.33	0.26	0.30	0.33	0.54	0.47
T4 (8% cow urine)	0.77	1.27	1.51	1.58	0.48	0.97	1.42	0.53	0.18	0.27	0.35	0.27	0.31	0.34	0.55	0.48
T5 (10% cow urine)	0.78	1.30	1.52	1.59	0.49	1.01	1.44	0.55	0.16	0.28	0.37	0.29	0.32	0.36	0.56	0.50
T6 (25 ppm NAA)	0.84	1.47	1.63	1.79	0.64	1.14	1.61	0.70	0.25	0.35	0.50	0.44	0.39	0.46	0.71	0.57
T7 (50 ppm NAA)	0.80	1.37	1.55	1.61	0.50	1.05	1.48	0.59	0.20	0.29	0.39	0.35	0.33	0.37	0.59	0.51
(4% cow urine + T8 25 ppm NAA)	0.86	1.49	1.65	1.80	0.65	1.16	1.63	0.71	0.26	0.37	0.52	0.46	0.40	0.47	0.73	0.59
(6% cow urine + T9 25 ppm NAA)	0.89	1.51	1.68	1.81	0.67	1.18	1.69	0.73	0.27	0.38	0.54	0.48	0.41	0.48	0.75	0.61
(8% cow urine + T10 25 ppm NAA)	0.91	1.55	1.69	1.82	0.68	1.19	1.70	0.75	0.24	0.41	0.59	0.5	0.44	0.51	0.77	0.67
(10% cow urine + T11 25 ppm NAA)	0.90	1.58	1.70	1.84	0.72	1.20	1.74	0.77	0.25	0.44	0.62	0.53	0.45	0.52	0.79	0.69
(4% cow urine + T12 50 ppm NAA)	0.79	1.40	1.56	1.67	0.55	1.07	1.50	0.61	0.20	0.30	0.41	0.37	0.34	0.38	0.61	0.51
(6% cow urine + T13 50 ppm NAA)	0.81	1.42	1.58	1.70	0.56	1.09	1.52	0.65	0.21	0.31	0.43	0.39	0.35	0.42	0.65	0.52
(8% cow urine + T14 50 ppm NAA)	0.78	1.44	1.60	1.71	0.58	1.10	1.54	0.67	0.22	0.32	0.47	0.41	0.36	0.43	0.67	0.53
(10% cow urine + T15 50 ppm NAA)	0.82	1.45	1.61	1.73	0.61	1.12	1.57	0.68	0.23	0.34	0.49	0.43	0.37	0.45	0.69	0.55
SE (m) ±	-	-	0.0087	0.0104	-	-	0.0248	0.0118	-	-	0.0079	0.0106	-	-	0.0966	0.0105
CD at 5%	-	-	0.0254	0.0300	-	-	0.072	0.0341	-	-	0.023	0.030	-	-	0.0280	0.0305

Table 2. Effect cow urine and NAA on protein content, 1000 grain weight, number of spikelets ear^{-1}, number of grains ear^{-1}, grain weight ear^{-1}, seed yield plant^{-1}, seed yield plot^{-1} and ha^{-1}

Treatments	Protein content	1000 grain weight (g)	Number of spikelets ear^{-1}	Number of grains ear^{-1}	Grain weight ear^{-1} (g)	Seed yield plant^{-1} (g)	Seed yield plot^{-1} (kg)	Seed yield ha^{-1} (q)
T_1 (Control)	12.14	41.76	12.32	31.15	1.25	6.25	1.29	31.15
T_2 (4% cow urine)	12.20	41.98	12.50	31.23	1.30	6.32	1.34	32.36
T_3 (6% cow urine)	12.30	42.10	13.65	31.63	1.34	6.31	1.37	33.07
T_4 (8% cow urine)	12.31	42.55	13.78	31.65	1.37	6.33	1.40	33.81
T_5 (10% cow urine)	12.44	43.01	13.92	31.70	1.39	6.48	1.42	34.27
T_6 (25 ppm NAA)	12.90	44.12	14.95	32.57	1.75	6.86	1.62	39.13
T_7 (50 ppm NAA)	12.55	43.09	14.21	31.72	1.44	6.45	1.44	34.74
T_8 (4% cow urine + 25 ppm NAA)	12.97	45.43	15.30	32.68	1.85	6.90	1.65	39.85
T_9 (6% cow urine + 25 ppm NAA)	13.15	45.68	15.60	32.90	1.87	7.10	1.68	40.53
T_{10} (8% cow urine + 25 ppm NAA)	13.24	45.70	15.65	33.14	2.04	7.15	1.70	41.01
T_{11} (10% cow urine + 25 ppm NAA)	13.50	45.90	15.70	33.20	2.12	7.33	1.87	45.16
T_{12} (4% cow urine + 50 ppm NAA)	12.57	43.12	14.32	31.95	1.48	6.65	1.49	35.98
T_{13} (6% cow urine + 50 ppm NAA)	12.70	43.18	14.71	32.40	1.55	6.63	1.54	37.15
T_{14} (8% cow urine + 50 ppm NAA)	12.80	43.98	14.89	32.44	1.58	6.61	1.56	37.68
T_{15} (10% cow urine + 50 ppm NAA)	12.85	44.10	14.90	32.50	1.60	6.69	1.58	38.16
SE (m)±	0.0119	0.3593	0.021	0.1724	0.0125	0.055	0.0168	0.2719
CD at 5%	0.0345	1.0410	0.0609	0.4994	0.0362	0.160	0.0488	0.7878

Seed yield plot^{-1} and ha^{-1}

Foliar application of growth regulators significantly increased seed yield plot^{-1} and ha^{-1} over control. The highest seed yield (1.87 kg plot^{-1} and 45.16 q ha^{-1}) was recorded in treatment 10% cow urine + 25 ppm NAA (T_{11}) as compared to (1.29 kg plot^{-1} and 31.15 q ha^{-1}) treatment T_1 (control).

Data regarding seed yield plot^{-1} and ha^{-1} exhibited similar trend. Significantly higher seed yield plot^{-1} and ha^{-1} was noticed in treatment 10% cow urine + 25 ppm NAA (T_{11}). Treatments 8% cow urine + 25 ppm NAA (T_{10}), 6% cow urine + 25 ppm NAA (T_9), 4% cow urine + 25 ppm NAA (T_8), 25 ppm NAA (T_6), 10% cow urine + 50 ppm NAA (T_{15}), 8% cow urine + 50 ppm NAA (T_{14}), 6% cow urine + 50 ppm NAA (T_{13}), 4% cow urine + 50 ppm NAA (T_{12}), 50 ppm NAA (T_7), 10% cow urine (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) in a descending manner also enhanced seed yield plot^{-1} and ha^{-1} significantly over control.

Chinmalwar *et al.* (2017) investigated the effect of foliar sprays of 4, 6, 8 % cow urine and 25, 50 ppm NAA alone and in combination on pigeonpea and observed that 4% cow urine + 50 ppm NAA significantly enhanced seed yield ha^{-1} as compared to control.

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