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EFFECT OF FOLIAR SPARAYS OF COW URINE AND NAA ON CHEMICAL, BIOCHEMICAL PARAMETERS AND YIELD OF PIGEONPEA

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ABSTRACT

The experiment was conducted to study the effect of two foliar sprays of different concentrations of NAA (25, 50 ppm NAA) and cow urine (4%, 6%, 8%) at 45, 65, 85, and 105 days after sowing on pigeonpea cultivar PKV-Tara. The experiment was laid out in RBD with spacing of 60 cm × 20 cm in *kharif* 2015-2016. Observations on chemical (N, P, K), biochemical (chlorophyll, protein), parameters were recorded at 45, 65, 85 and 105 days after sowing. Observations on number of pods plant^{-1}, test weight, seed yield plant^{-1}, seed yield plot^{-1} were also recorded after harvesting. Considering the cow urine concentrations, 6% cow urine spray and 50 ppm NAA alone and in combination were found more effective in enhancing the chemical, biochemical, yield and yield contributing parameters when compared with control.

(Key words: Pigeonpea, cow urine, NAA, foliar application, chemical, biochemical and yield contributing parameters)

INTRODUCTION

The pigeopea has a noticeably higher soil adaptability in comparison to other leguminous crops. This proves that pigeonpea is a better performing nitrogen fixer. Growing pigeonpea is profitable enough as these plants yield in less fertile soil and require only normal rainfall. Pods of pigeonpea vary in size and colour ranging from green to purple or dark brown. Raw pigeonpea seeds extracted from green coloured pods generally are said to be better than those extracted from purple pods. Interest in this crop is growing in many countries because of its multiple use as source of food, livestock fodder and also improves soil fertility. Pigeonpea is nutritionally important as it contains protein 22.3 %, fat 1.7 %, calcium 7.3 mg, thiamine 0.45 mg, riboflavin 0.19 mg, niacin 2.9 mg. Besides this they are also the sources of minerals and some vitamins.

Cow urine is having nutrients like N 1%, K_2O 1.9% and P_2O_5 in traces (Tamhane *et al.*, 1965). Agrawal (2002) reported cow urine contains N, P, K, Na, S, Ca, Mg, Cu, I, NH_3, silver, urea, uric and oxalic acid, lead, hipuric acid, crietinine, eltine, enzymes, steroids phosphates, lead, propiline oxide, ethylene oxide, glycosides, glucose, citric acid, alkalide, acetate, endesonine, carbolic acid and growth substances.

NAA (Naphthalene Acetic Acid) is the synthetic auxin with the identical properties to that naturally occuring auxin. It prevents formation of abscission layer and thereby flower drop. It was observed that the growth regulators are involved in the direct transport of assimilates from source to sink (Sharma *et al.*, 1989).

Considering the above facts the field experiment was conducted to investigate the effect of foliar applications of cow urine and NAA on chemical, biochemical parameters, yield and yield contributing parameters of pigeonpea.

MATERIALS AND METHODS

The physiological responses of foliar sprays of cow urine (4, 6 and 8 %) and NAA (25, 50 ppm) on the morphophysiological, biochemical, chemical and yield and yield contributing parameters of pigeonpea PKV- Tara was studied during *kharif* 2015 at the experimental farm of Botany Section, College of Agriculture, Nagpur. The experiment was laid out in RBD with three replications consisting of twelve treatments comprising of different concentrations of cow urine and NAA along with their various concentrations. Two foliar sprays were given at 45 and 65 DAS. Observations on nitrogen, phosphorus, potassium, chlorophyll were recorded at 45, 65, 85 and 105 DAS. Protein content in seed is also estimated after harvesting. Observations on test weight, number of pods plant^{-1}, number seeds pod^{-1}, seed yield plant^{-1}, seed yield plot^{-1} were also recorded. Chlorophyll was estimated by colorimeter as per method suggested by Brusinma (1982). Nitrogen content in leaves and protein content in seeds were determined by micro-kjeldahl's method as given by Jackson (1967). Potassium content in leaves was determined by flame photometer by diacid extract method as given by Jackson (1967). Yield and yield

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contributing parameters viz., Number of pods plant^{-1}, number of seeds pod^{-1} and test weight were also recorded.

RESULTS AND DISCUSSION

Leaf nitrogen content

Leaf nitrogen was not significantly enhanced by different treatments of cow urine and NAA at 1st stage of observation (45 DAS). Leaf nitrogen at 65 DAS was significantly enhanced by the treatments 4% cow urine + 50 ppm NAA (T_{10}) and 6% cow urine + 50 ppm NAA (T_{11}) followed by 8% cow urine +50 ppm NAA (T_{12}) and 6% cow urine + 25 ppm NAA (T_8) over control and rest of the treatments in a descending manner. Similarly treatments 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 chlorophyll significantly when compared with control and rest of the treatments. But treatments 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1).

Leaf nitrogen at 85 DAS was significantly enhanced by the treatments 4% cow urine + 50 ppm NAA (T_{10}) and 6% cow urine + 50 ppm NAA (T_{11}) followed by 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. But treatments 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 (T_1).

Nitrogen content at 105 DAS was significantly enhanced by treatments 4% cow urine + 50 ppm NAA (T_{10}) and 6% cow urine + 50 ppm NAA (T_{11}). Next to these two treatments, treatments were 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 rest of the treatments and control in enhancing N content. Treatments 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 (T_1).

Arsode (2013) studied the effect of foliar application of humic acid through cowdung wash and NAA and stated that 50 ppm NAA + 300 ppm HA through cowdung wash significantly increased leaf nitrogen content in mustard.

Leaf phosphorus content

Data showed significance at all the stages of observations viz., 65, 85 and 105 DAS except 45 DAS stage. At 65 DAS treatments 4% cow urine + 50 ppm NAA (T_{10}), 6% cow urine + 50 ppm NAA (T_{11}) and 8% cow urine +50 ppm NAA (T_{12}) were increased leaf phosphorus content over control and rest of the treatments. 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 (T_1).

At 85 DAS treatments 4% cow urine + 50 ppm NAA (T_{10}) followed by 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), 8% cow urine +25 ppm NAA (T_9), 50 ppm NAA (T_6) and 25 ppm NAA (T_5), significantly increased leaf phosphorus content when compared with control and remaining treatments under study. Treatments 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1).

At 105 DAS treatment 4% cow urine + 50 ppm NAA (T_{10}) followed by 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}) and 4% cow urine + 25 ppm NAA (T_7), were increased leaf phosphorus content significantly over control and rest of the treatments. Moreover, treatments 8% cow urine +25 ppm NAA (T_9), 50 ppm NAA (T_6) and 6% cow urine + 25 ppm NAA (T_8) also recorded significantly more leaf phosphorus content over control and rest of the treatments. But treatments 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 (T_1).

Ingle (2007) observed that the foliar application of 6% cow urine + 50 ppm NAA increased phosphorus content in leaf of black gram. Bagde (2008) noted that foliar application of 12% cow urine of Holstein Friesian breed increased phosphorus content in leaves of cotton as compared to cow urine of other breeds.

Leaf potassium content

Data were subjected to statistical analysis and were found significant at 65, 85 and 105 DAS stages. Potassium content at 45 DAS by the application of different treatments were found non significant. Potassium content at 65 DAS was significantly maximum in treatments 4% cow urine + 50 ppm NAA (T_{10}) and 6% cow urine + 50 ppm NAA (T_{11}) followed by 8% cow urine +50 ppm NAA (T_{12}), 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) and 6% cow urine (T_3) in a descending manner when compared with treatment 4% cow urine (T_2) and control (T_1).

Potassium content at 85 DAS and 105 DAS was found significantly more in treatment 4% cow urine + 50 ppm NAA (T_{10}), 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). 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), also achieved significantly more potassium content at this stages of observations when compared with remaining four treatments i.e. 8% cow urine (T_4), 6% cow urine (T_3), 4% cow urine (T_2) and control (T_1).

Basole *et al.* (2003) reported that foliar application of hormones (NAA 50 ppm) and nutrients viz., $FeSO_4$, KNO_3, $ZnSO_4$, $MgSO_4$ 0.5 % on soybean increased potassium content in leaves significantly.

Chlorophyll content in leaves

Data regarding chlorophyll content in leaves at 45 DAS was found to be non significant. At the 65 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}), 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8), 4% cow urine + 25 ppm NAA (T_7), 8% cow urine +25 ppm NAA (T_9) and 50 ppm NAA (T_6). But treatments 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 85 DAS chlorophyll content in leaves ranged from 1.55-1-09 mg g^{-1}. Significantly highest chlorophyll was found in combination treatment of 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}), 6% cow urine + 25 ppm NAA (T_8) when compared with control and rest of the treatments. Similarly treatments 4% cow urine + 25 ppm NAA (T_7) and 8% cow urine +25 ppm NAA (T_9) also increased leaf chlorophyll significantly when compared with control and rest of the treatments. But treatments 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 (T_1).

At 105 DAS chlorophyll content in leaves ranged from 0.99-0.78 mg g^{-1}. Significantly highest chlorophyll was found in combination treatment of 4% cow urine + 50 ppm NAA (T_{10}). Next to this treatment, teatments were 6% cow urine + 50 ppm NAA (T_{11}), 8% cow urine +50 ppm NAA (T_{12}), 6% cow urine + 25 ppm NAA (T_8) when compared with control and rest of the treatments. 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) , 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1) in chlorophyll content in leaves.

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 chlorophyll.

Protein content in seeds

Treatment considering for evaluation of this study were found significantly superior over control. However, 4% cow urine + 50 ppm NAA (T_{10}) recorded the highest protein content i.e. 22.95%, while control (T_1) treatment recorded minimum i.e. 19.23%.

Data regarding protein content in seeds was found significant. Treatments 4% cow urine + 50 ppm NAA (T_{10}), 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), 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) significantly increased protein content when compared with control (T_1). 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 protein content in seeds over control.

Number of pods plant^{-1}

Number of pods plant^{-1} significantly increased in treatments 4% cow urine + 50 ppm NAA (T_{10}), 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), 8% cow urine +25 ppm NAA (T_9) and 50 ppm NAA (T_6) in a descending manner when compared with remaining treatments and control. Treatments 25 ppm NAA (T_5), 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) were remained at par with control (T_1) in respect of number of pods plant^{-1}.

Number of seeds pod^{-1}

In general it can be said that foliar application of cow urine and NAA significantly enhanced number of seeds pod^{-1} when compared with control. Treatments 4% cow urine + 50 ppm NAA (T_{10}), 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), 8% cow urine +25 ppm NAA (T_9) and 50 ppm NAA (T_6) significantly enhanced number of seeds pod^{-1} when compared with control and rest of the treatments. Similarly treatments 25 ppm NAA (T_5) and 8% cow urine (T_4) also significantly increased number of seeds pod^{-1} when compared with control. But treatments 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1).

Test weight

Significantly maximum 100 seed weight were recorded in treatments 4% cow urine + 50 ppm NAA (T_{10}), 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). Treatments 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 (T_1) in respect of test weight.

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 100 seed weight over control.

Seeds yield

The maximum seed yield plant^{-1}, plot^{-1} were recorded in treatment 4% cow urine + 50 ppm NAA (T_{10}). The range of increase in seed yield plant^{-1}, plot^{-1} was 13.60 g, 1.74 kg and 14.50 q in treatment T_1 (control) to 17.30 g, 2.41 kg and 20.10 q in treatment 4% cow urine + 50 ppm NAA (T_{10}). Significantly maximum grain yield plant^{-1}, plot^{-1}, were recorded in treatments 4% cow urine + 50 ppm NAA (T_{10}), 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) in a descending manner when compared with control and rest of the treatments. Treatments 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 (T_1).

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

Treatment	Leaf nitrogen content (%)				Leaf phosphorus content (%)				Leaf potassium content (%)			
	45 DAS	65 DAS	85 DAS	105 DAS	45 DAS	65 DAS	85 DAS	105 DAS	45 DAS	65 DAS	85 DAS	105 DAS
T_1 (Control)	2.436	3.116	3.013	2.916	0.836	0.843	0.651	0.611	0.420	0.600	0.583	0.480
T_2 (4% cow urine)	2.310	3.236	3.086	3.000	0.806	0.853	0.684	0.651	0.436	0.620	0.610	0.533
T_3 (6% cow urine)	2.786	3.446	3.193	3.040	0.852	0.855	0.701	0.674	0.413	0.730	0.646	0.536
T_4 (8% cow urine)	2.876	3.633	3.243	3.076	0.849	0.865	0.724	0.689	0.453	0.733	0.690	0.573
T_5 (25 ppm NAA)	2.693	3.763	3.343	3.116	0.875	0.894	0.770	0.699	0.446	0.755	0.710	0.596
T_6 (50 ppm NAA)	2.583	3.970	3.396	3.136	0.904	0.916	0.804	0.709	0.556	0.772	0.740	0.616
T_7 (4% cow urine + 25 ppm NAA)	2.376	4.076	3.786	3.496	0.940	0.942	0.839	0.739	0.476	0.836	0.793	0.676
T_8 (6% cow urine + 25 ppm NAA)	2.756	4.396	3.816	3.716	0.945	0.954	0.896	0.764	0.573	0.893	0.883	0.696
T_9 (8% cow urine + 25 ppm NAA)	2.393	4.046	3.516	3.313	0.920	0.926	0.809	0.719	0.539	0.816	0.773	0.633
T_{10} (4% cow urine + 50 ppm NAA)	2.123	5.296	4.746	4.513	0.939	1.050	0.982	0.819	0.586	1.143	0.946	0.783
T_{11} (6% cow urine + 50 ppm NAA)	2.483	5.146	4.203	4.096	0.959	1.029	0.953	0.799	0.606	1.113	0.903	0.753
T_{12} (8% cow urine + 50 ppm NAA)	2.773	4.430	4.136	4.076	0.961	1.007	0.914	0.779	0.653	0.916	0.896	0.726
SE(m) ±	0.471	0.183	0.167	0.161	0.041	0.040	0.035	0.0294	0.058	0.0381	0.035	0.0294
CD at 5%	-	0.537	0.490	0.474	-	0.119	0.103	0.086	-	0.111	0.104	0.0863

Table 2. Effect of cow urine and NAA on chlorophyll content in leaves, protein content in seeds, number of pods plant^{-1},test weight, seed yield plant^{1} and seed yield plot^{-1} in pigeonpea

Treatments	Leaf chlorophyll content (mg g^{-1})				Protein content (%)	Number of pods plant^{-1}	Number of seeds pods^{-1}	Test weight (g)	Seed yield plant^{-1} (g)	Seed yield plot^{-1} (kg)
	45 DAS	65 DAS	85 DAS	105 DAS						
T_1 (Control)	0.969	1.116	1.096	0.783	19.23	96.31	2.71	7.98	13.60	1.74
T_2 (4% cow urine)	0.933	1.153	1.126	0.796	21.76	106.67	3.40	8.82	13.96	1.80
T_3 (6% cow urine)	1.093	1.243	1.196	0.813	21.94	108.71	3.42	8.88	14.31	1.86
T_4 (8% cow urine)	0.906	1.273	1.236	0.826	22.16	115.00	3.55	9.33	14.76	1.93
T_5 (25 ppm NAA)	1.156	1.293	1.253	0.843	22.17	117.33	3.60	9.65	15.00	1.98
T_6 (50 ppm NAA)	1.146	1.316	1.276	0.863	22.46	120.00	3.65	9.96	15.05	2.01
T_7 (4% cow urine + 25 ppm NAA)	1.264	1.446	1.343	0.893	22.77	125.00	3.75	10.53	15.71	2.14
T_8 (6% cow urine + 25 ppm NAA)	1.026	1.476	1.393	0.916	22.80	128.00	3.79	10.98	16.09	2.20
T_9 (8% cow urine + 25 ppm NAA)	1.233	1.323	1.296	0.876	22.76	122.00	3.72	10.03	15.56	2.10
T_{10} (4% cow urine + 50 ppm NAA)	1.000	1.566	1.550	0.990	22.95	135.72	4.56	11.36	17.23	2.41
T_{11} (6% cow urine + 50 ppm NAA)	1.061	1.536	1.506	0.953	22.89	135.00	4.02	11.17	16.58	2.27
T_{12} (8% cow urine + 50 ppm NAA)	0.966	1.516	1.480	0.936	22.81	129.94	3.80	11.02	16.40	2.26
SE(M)±	0.244	0.062	0.056	0.038	0.680	7.867	0.279	0.756	0.720	0.129
CD at 5%	_	0.184	0.165	0.111	1.997	23.075	0.818	2.218	2.114	0.381

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.The significantly highest grain yield (g plant^{-1}) recorded in 20 and 30 ppm followed by all the concentrations of GA_3 and Kinetin.

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