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EFFECT OF COW URINE AND NAA ON MORPHO-PHYSIOLOGICAL PARAMETERS AND YIELD OF WHEAT

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ABSTRACT

Present investigation was undertaken at farm of Botany , College of Agriculture, Nagpur, during *rabi* 2017-2018 to study the effect of two foliar sprays of 25 and 50 ppm NAA and 4%, 6%, 8% and 10% cow urine alone and in combination with one control as a water spray on morpho-physiological parameters and yield of wheat. Data revealed that treatment 10% cow urine with 25 ppm NAA significantly increa9sed plant height, number of tillers m^{-1} row length, leaf area, dry weight, RGR, NAR, seed yield ha^{-1} and harvest index. Considering the Benefit : Cost ratio of application 10% cow urine with 25 ppm NAA was found more economical having B:C ratio of 2.41 as compared to 1.74 in control.

(Key words:Wheat, cow urine, NAA,foliar application,morpho-physiological para meters, 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. In India the top ten wheat producing states are Uttar Pradesh, Punjab, Haryana, Madhya Pradesh, Rajasthan, Bihar, Gujarat, Maharashtra, Uttaranchal and West-Bengal. In India, wheat is the most important food grain after rice in terms of both area and production which contribute 12% of the world wheat pool. Wheat requires cool climate. Wheat genetics is more complicated than most other domesticated species, some species are diploid but many are stable polyploids. Diploid (2n) chromosome number of wheat is 14.

Cow urine is having nutrients like N 1%, K_2O 1.9% and P_2O_5 in traces (Tamhane *et al.*, 1965). 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 (Agrawal, 2002).

NAA (Naphthalene Acetic Acid) is the synthetic auxin with the identical properties to that naturally occurring 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).

This experiment aimed to investigate the effect of foliar applications of cow urine and NAA on morpho-physiological parameters and yield of wheat.

MATERIALS AND METHODS

The field experiment was conducted during *rabi* season of year 2017-18 at experimental farm of Agricultural Botany Section, College of Agriculture, Nagpur with the object to know the effect of foliar sprays of cow urine and NAA on morpho- physiological parameters and yield of wheat. This experiment was carried out in RBD with 3 replications. Two foliar sprays of cow urine (4%, 6%, 8% and 10%) and NAA (25 and 50 ppm) alone and in combination were given as per treatments (Table 1) at 45 and 60 DAS.AKW-3722 cultivar of wheat was used in the experiment. Observations on plant height and number of tillers m^{-1} were recorded at the time of maturity. Leaf area and dry weight of plant were recorded at 45, 60 and 75 DAS. RGR and NAR were also calculated at 45-60 and 60-75 DAS. Seed yield ha^{-1} was recorded. Harvest index was also calculated.The observed data were analyzed statistically using analysis of variance at 5% level of significance (Panse and Sukhamate, 1967).

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RESULTS AND DISCUSSION

Plant height

Height is an important measure of growth. It is one of the visiable measurements and is a function of internodes and leaf emergence. Since, leaves are born on stem, leaf area development and biomass production shows a close relationship with plant height.

Plant height under various treatments was recorded at harvesting. The data are presented in table 1. Significant variation was observed in plant height at maturity stage. Significantly maximum plant height at harvest recorded in treatment 10% cow urine + 25 ppm NAA (T_{11}) and 8% cow urine + 25 ppm NAA (T_{10}). Next to this treatment, 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 significantly more plant height when compared with control.

Foliar application of cow urine and hormone individually and in combination increased plant height. It is known that cow urine is a source of major nutrients like N, P, K and other essential elements. These elements are quickly absorbed by plant when it applied as foliar spray. N,P,K are associated with different plant processes viz., cell enlargement, translocation of solute, formation of carbohydrate etc. Similarly, application of growth regulator also enhances the absorption and transport of nutrients. Hence, it facilitates fast availability of nutrient and growth of the plant. These might be the reasons for increasing the plant height in the present investigation.

Chinmalwar *et al.* (2017) studied the effect of two foliar sprays of 4, 6, 8 % cow urine and 25, 50 ppm NAA alone and in combination on morpho-physiological parameters of pigeonpea. Data revealed that treatment 4% cow urine + 50 ppm NAA significantly increased plant height over control.

Number of tillers plant^{-1}

The data on number of tillers m^{-1} row length were recorded at harvesting. Significant variations were observed at harvest stage. Significantly maximum numbers of tillers were recorded by the combination of 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) over control and rest of the treatments. 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) were also found significantly superior in number of tillers m^{-1} row length over control (T_1).

Singh *et al.* (2015) noted that foliar application of 50 ppm NAA significantly enhanced number of branches plant^{-1} over control in fenugreek.

Leaf area plant^{-1}

Leaf area plant^{-1} depends upon the number and size of leaves. Leaf size is influenced by light, moisture and nutrients. Photosynthetic capacity of the plant is a function of leaf area development. Leaf area ultimately is a decisive factor of yield of particular crop.

The data on leaf area plant^{-1} were recorded at three growth stages i.e. 45, 60, 75 DAS. At 60 DAS and 75 DAS leaf area plant^{-1} was significantly influenced by different treatments.

At 60-75 DAS leaf area plant^{-1} was increased significantly by the treatment 10% cow urine + 25 ppm NAA (T_{11}). Similarly 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 leaf area significantly over control.

Hence, it can be inferred that when nutrients and hormones applied through foliar spray, might have accelerated the metabolic and physiological activities of plant and put up more growth by assimilating more amount of major nutrients and ultimately increased leaf area of plant in present investigation.

Deotale *et al.* (2011) studied the effect of two foliar sprays of different concentrations of NAA (50 ppm) and cow urine (2%, 4% and 6%) sprayed at 25 and 40 days after sowing on soybean cultivar JS-335. Considering the cow urine concentrations 6% cow urine spray and 50 ppm NAA alone and in combination was found more effective in enhancing the leaf area.

Dry matter plant^{-1}

Data regarding dry matter accumulation of wheat plant^{-1} were recorded at 45, 60 and 75 DAS.Dry matter is an important criterion. It determines the source-sink relationship and depends upon the net gain in the processes on anabolism and catabolism of plant. At 45 DAS the data regarding dry matter production were found non-significant because foliar sprays of cow urine and NAA of different concentrations were given from this stage onwards (45 and 60 DAS).

At 60 DAS dry matter was increased significantly by the 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) over control and rest of treatments. 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) were also found significantly superior over treatments 4% cow urine (T_2) and control also.

At 75 DAS the highest dry matter production was noticed by the application of 10 % cow urine + 25 ppm NAA (T_{11}). This treatment was significantly superior over control and other treatments also. 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 significantly increased total dry weight of plant over control.

The inferences drawn from data it is clear that dry matter rapidly increased from 1st to 2nd stage of observation. Dry matter accumulation is a function of leaf area and more leaf area was observed during 60-75 DAS and it is period of maximum photosynthesis, yielded maximum dry matter production.

A field experiment conducted by Deogirkar (2010) to study 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 morpho-physiological parameters of chickpea cv.Jaki. The results showed that two foliar sprays of 6% cow urine significantly increased the dry matter production over control.

Growth analysis

Growth analysis is one of the measures for accessing the seed yield of plant. The physiological basis of yield difference can measured through an evaluation of difference in growth parameters and their impact on yield. The productivity of crop may be related with the parameters such as RGR, NAR and partitioning of total photosynthates into economic and non-economic sink.

Relative Growth Rate

The highest rate of RGR indicates the ability of maximum dry matter for development. The increment in RGR might be associated with maximum leaf area expansion and growth of stem and root. Increment in NAR is related with the increase in total dry weight of plant unit^{-1} of leaf area.

Significantly maximum RGR was noted in 10 % cow urine + 25 ppm NAA (T_{11}) treatment i.e 0.0379 g g^{-1} day^{-1}, while it was lowest in control i.e 0.0304 g g^{-1} day^{-1} at 45-65 DAS. Treatments 10% cow urine + 25ppm NAA (T_{11}), 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) recorded significantly highest RGR over control and rest of the treatments. Treatments 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 RGR significantly when compared with control and rest of the 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) in RGR.

During 2nd phase (60-75 DAS) significantly maximum RGR was observed in treatment 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) over control and rest of the treatments. 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) were also increased RGR significantly when compared with control (T_1).

Ingle (2007) tested 50 ppm NAA and 2, 4 and 6% cow urine on black gram as foliar spray and found that 6% cow urine + 50 ppm NAA increased RGR over control.

Net Assimilation Rate

NAR is closely connected with photosynthetic efficiency of leaves, but it is not a pure measure of photosynthesis. NAR depends upon the excess dry matter gained, over the loss in respiration. It is increase in plant dry weight unit^{-1} area of assimilatory tissue unit^{-1} time.

Considering the treatments under study, during 1st phase (45-60 DAS) significantly maximum NAR was noted in treatments 10% cow urine + 25ppm NAA (T_{11}), 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}) and 6% cow urine + 50 ppm NAA (T_{13}) over control and remaining treatments under study. Treatments 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) in a descending manner were also enhanced NAR significantly when compared with treatment 4% cow urine (T_2) and control (T_1).

During 2nd phase (60-75 DAS) significantly maximum NAR was observed in treatments 10% cow urine + 25ppm NAA (T_{11}), 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) and 10% cow urine + 50 ppm NAA (T_{15}) over control and other treatments under study. Treatments 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 their significance over treatments 4% cow urine (T_2) and control (T_1) also.

Net assimilation rate (NAR) synonymously called as unit leaf rate expresses the rate of dry weight increase at any instant on a leaf area basis with leaf representing an estimate of the size of the assimilatory surface area (Gregory, 1926). Decrease in NAR during reproductive phase might be due to decrease efficiency of leaves for photosynthesis as a response to photosynthetic apparatus to increase demand for assimilates by growing seed fraction and sink demand on photosynthetic rate of leaves.

A field experiment laid out by Thakare *et al.* (2006) to examine the effect of nutrients (2% DAP, 2% urea, 2-10% cow urine) and hormones (IAA and NAA 50 ppm) on soybean. Foliar spray of IAA + DAP significantly increased NAR as compared to RDF. Experimental data showed that

Table 1. Effect of cow urine and NAA on plant height plant^{-1}, number of tillers m^{-1}row length, leaf area (dm^2) and dry matter plant^{-1}(g) in wheat

Treatments	Plant height plant^{-1} (cm)	Number of tillers m^{-1} row length	Leaf area (dm^2)			Dry mattert plant^{-1} (g)		
			45 DAS	60 DAS	75 DAS	45 DAS	60 DAS	75 DAS
T_1 (Control)	72.14	305	1.01	1.12	1.35	5.02	7.92	11.20
T_2 (4% cow urine)	73.15	314	1.02	1.14	1.38	5.04	8.07	11.50
T_3 (6% cow urine)	73.40	316	1.03	1.15	1.41	5.06	8.17	11.71
T_4 (8% cow urine)	74.50	317	0.95	1.18	1.43	5.07	8.19	11.82
T_5 (10% cow urine)	75.19	318	0.96	1.21	1.45	5.03	8.25	11.96
T_6 (25 ppm NAA)	81.73	340	0.99	1.36	1.58	5.08	8.66	13.09
T_7 (50 ppm NAA)	76.33	320	1.01	1.23	1.47	5.08	8.42	12.30
T_8 (4% cow urine + 25 ppm NAA)	82.11	342	1.02	1.39	1.60	5.04	8.72	13.25
T_9 (6% cow urine + 25 ppm NAA)	83.17	350	1.01	1.43	1.63	5.03	8.76	13.40
T_{10} (8% cow urine + 25 ppm NAA)	85.12	352	1.02	1.47	1.64	5.05	8.87	13.60
T_{11} (10% cow urine + 25 ppm NAA)	85.15	354	1.01	1.51	1.66	5.04	8.90	13.71
T_{12} (4% cow urine + 50 ppm NAA)	77.14	321	1.01	1.25	1.49	5.10	8.47	12.41
T_{13} (6% cow urine + 50 ppm NAA)	79.00	324	1.02	1.28	1.52	5.03	8.51	12.58
T_{14} (8% cow urine + 50 ppm NAA)	80.12	325	1.01	1.32	1.55	5.05	8.58	12.81
T_{15} (10% cow urine + 50 ppm NAA)	80.15	337	0.99	1.34	1.56	5.06	8.61	12.94
SE(m) ±	0.0210	1.234	-	0.00149	0.00086	-	0.0539	0.022
CD at 5%	0.611	3.574	-	0.00432	0.00249	-	0.1561	0.0637

Table 2.Effect of cow urine and NAA on RGR and NAR seed yield ha^{-1}, per cent increase in yield, B:C ratio and harvest index in wheat

Treatments	RGR (g g^{-1} day^{-1})		NAR (g dm^{-2} day^{-1})		Seed yield ha^{-1}	Harvest index (%)
	45-60 DAS	60-75 DAS	45-60 DAS	60-75 DAS		
T1 (Control)	0.0304	0.0231	0.18170	0.17757	6.25	42.43
T2 (4% cow urine)	0.0314	0.0236	0.18723	0.18203	6.32	43.36
T3 (6% cow urine)	0.0319	0.0240	0.19041	0.18501	6.31	43.89
T4 (8% cow urine)	0.0320	0.0245	0.19607	0.18601	6.33	44.44
T5 (10% cow urine)	0.0330	0.0248	0.19873	0.18647	6.48	44.77
T6 (25 ppm NAA)	0.0356	0.0275	0.20482	0.20128	6.86	48.07
T7 (50 ppm NAA)	0.0337	0.0253	0.19945	0.19211	6.45	45.11
T8 (4% cow urine + 25 ppm NAA)	0.0365	0.0279	0.20522	0.20234	6.90	48.53
T9 (6% cow urine + 25 ppm NAA)	0.0370	0.0283	0.20587	0.20247	7.10	48.95
T10 (8% cow urine + 25 ppm NAA)	0.0376	0.0285	0.20682	0.20299	7.15	49.24
T11 (10% cow urine + 25 ppm NAA)	0.0379	0.0288	0.20698	0.20246	7.33	51.65
T12 (4% cow urine + 50 ppm NAA)	0.0338	0.0255	0.19957	0.19222	6.65	45.98
T13 (6% cow urine + 50 ppm NAA)	0.0351	0.0261	0.20261	0.19429	6.63	46.78
T14 (8% cow urine + 50 ppm NAA)	0.0353	0.0267	0.20321	0.19694	6.61	47.13
T15 (10% cow urine + 50 ppm NAA)	0.0354	0.0272	0.20470	0.19946	6.69	47.47
SE (m) ±	0.0006	0.0002	0.0021	0.0017	0.055	0.37
CD at 5%	0.0017	0.0006	0.0061	0.0047	0.160	1.110

the treatments of IAA + DAP or urea, NAA + DAP or urea and 6% cow urine + DAP or urea along with ½ RDF were also found effective in improving all parameters over RDF (control).

Seed yield ha^{-1}

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

Significantly higher seed yield 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 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.

Harvest index

Data were found statistically significant. Significantly maximum harvest index was recorded in treatment 10% cow urine + 25 ppm NAA (T_{11}) and minimum in control (T_1). The range of increased harvest index was 51.56% in treatment 10% cow urine + 25 ppm NAA (T_{11}) when compared to control (T_1) 42.43%.

Harvest index was significantly increased in all treatments studied and it was highest in 10% cow urine + 25 ppm NAA (T_{11}). Treatments 25 ppm NAA (T_{11}), 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 harvest index significantly in a descending manner when compared with control.

Harvest index was significantly increase in treatment receiving 4% cow urine + 50 ppm NAA as reported by Chute (2017).

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