J. Soils and Crops 27 (1) 198-203, June 2017 ISSN 0971-2836

INFLUENCE OF COW URINE AND NAA ON MORPHO-PHYSIOLOGICAL PARAMETERS AND YIELD OF PIGEONPEA

Yogita Chinmalwar[1], R. D. Deotale[2], V. J. Surywanshi[3], M. R. Neware[4],

B. B. Pandy[5] and V. R. Jaybhaye[6]

ABSTRACT

Present investigation was undertaken at farm of Botany, College of agriculture, Nagpur, during *kharif* 2015-2016 to study the influence of two foliar sprays of 4, 6, 8% cow urine and 25, 50 ppm NAA alone and in combination on morpho-physiological parameters and yield of pigeonpea. Data revealed that treatment 4% cow urine + 50 ppm NAA significantly increased plant height, number of branches, leaf area, dry weight, RGR, NAR, seed yield ha^{-1} and harvest index.

(Key words: Pigeonpea, cow urine, NAA, foliar application, morpho-physiological parameters, yield)

INTRODUCTION

Pigeonpea is one of the major pulse crop cultivated in India. Pigeonpea have excellent source of high quality of protein. It is mainly cultivated and consumed in developing countries of the world. Pigeonpea (*Cajanus cajan* (L.) Mill sp.) having chromosome number 2n=22 belongs to family Leguminoceae and subfamily "Papilinaceae". It is also known as Arhar, Red gram and Tur. This crop is widely grown in India and India is the largest producer and consumer of pigeonpea in the world. Major pigeonpea producing countries are India, Myanmar, Malawi, Uganda. Genarally pigeonpea is a shrub which grows around a meter tall, and it has special short season varieties available as well. Usually the flowering response is enhanced when daylight is 11 to 12 hours long. However, due to scientific advances hybrid varieties are available as well which respond to both longer and shorter day lengths equally.

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

Suemitsu *et al.* (1968) examined cow urine for its acidic and phenolics content. They obtained benzoic acid (68.4%), phenylacetic acid (17.4%), á-hydroxybenzoic acid (1.75%) á-phenylpropinic acid (0.7%), 3- indole acetic acid (0.1%), â-3-indole propionic acid (0.55%), 3,4-dimethoxy benzoic acid (0.99%). They also obtained phenolic compounds in cow urine.

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).

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

MATERIALS AND METHODS

The field experiment was conducted during *kharif* season in 2015-16 at experimental farm of Agricultural Botany Section, College of Agriculture, Nagpur with the object to know the influence of foliar sprays of nutrients and hormones on morpho- physiological parameters and yield of pigeonpea. This experiment was carried out in RBD with 3 replications (Table 1). Two foliar sprays of nutrients and hormones individually and in combination were given as per treatments (Table 1) at 45 and 65 DAS. PKV-Tara cultivar of pigeonpea was used in the experiment. Observations on plant height and number of branches were recorded at the time of harvesting. Leaf area and dry weight of plant were recorded at 45, 65, 85 and 105 DAS stages. RGR and NAR were also calculated at 45-65, 65-85 and 85-105 DAS stages. Seed yield ha^{-1} were recorded. Harvest index was also calculated.

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

1, 3, 4, 5 and 6. P.G. Students, Botany Section, College of Agriculture, Nagpur
2. Professor, Botany Section, College of Agriculture, Nagpur

area development and biomass production shows a close relationship with plant height.

Significantly maximum plant height 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) and 8% cow urine +25 ppm NAA (T_9). Treatments of 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).

Upaydhyay and Rajan (2015) tried different concentrations of growth regulators (10, 20, 30 ppm NAA, GA_3, 10, 20, 30 ppm and Kinetin 10,20, 30 ppm) on soybean. They observed significantly more plant height over control.

Number of branches plant^{-1}

Branches are the sites of the leaves, flowers, and pod formation. Hence, they are closely associated with the photosynthetic activity and yield of plant. So, more number of branches is a desirable attribute for higher biomass production and yield.

Significant increase in the number of branches plant^{-1} was observed. The range of number of branches observed was 24.96 -28.51. Treatment 4% cow urine + 50 ppm NAA (T_{10}) was found significantly superior in increasing number of branches 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 (T_7) when compared with control and other treatments. It was also noticed that the treatments like 8% cow urine + 25 ppm NAA (T_9) and 50 ppm NAA (T_6) also increased number of branches over control and remaining treatments. 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).

Leaf area plant^{-1}

Leaf area play a key role in absorption of radiation in the deposition of photosynthesis during the diurnal and seasonal cycles. Leaf area depends on the number and size of the leaves and hence, the total leaf is an important parameters for assessing the ability of plant to synthesis its dry matter. The photosynthetic capacity of plant is a function of leaf area development.

Leaf area at 45 DAS was found non significant because spraying was done on the same day. At 65 DAS leaf area was significantly higher in 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 6% cow urine + 25 ppm NAA (T_8) when compared with control and rest of the treatments under study. Treatments 4% cow urine + 25 ppm NAA (T_7), 8% cow urine + 25ppm 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 leaf area.

At 85 DAS the treatment 4% cow urine + 50 ppm NAA (T_{10}) was found superior in respect of leaf area over all the treatments and control, but 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), 8% cow urine + 25ppm NAA(T_9) were found at par with this treatment. 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 leaf area plant^{-1} was significantly influenced by different treatments. At this stage 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 6% cow urine + 25 ppm NAA (T_8) exhibited maximum leaf area in a desending manner when compared with control and rest of the treatments. Similarly 4% cow urine + 25 ppm NAA (T_7) and 8% cow urine + 25ppm NAA (T_9) also recorded more leaf area when compared with control. 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) in leaf area plant^{-1}.

Upaydhyay and Rajan (2015) tried different concentrations of growth regulators (10, 20, 30 ppm NAA, GA_3, 10, 20, 30 ppm and Kinetin 10,20, 30 ppm) on soybean. They observed significantly increased leaf area plant^{-1}over control.

Dry weight plant^{-1}

Data regarding dry matter gave significant variation at 65, 85 and 105 DAS. At 45 DAS the dry matter accumulation was found non significant. At all the stages of observations foliar application of 4% cow urine + 50 ppm NAA (T_{10}) produced significantly more dry matter and stood first in rank.

At 65 DAS dry matter was increased significantly 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), 4% cow urine + 25 ppm NAA (T_7). 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) in respect of dry matter production.

At 85 DAS the highest dry matter production was noticed by the application of 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). Significantly lowest dry matter production was observed in treatments 25 ppm NAA (T_5), 8% cow urine (T_4), 6% cow urine (T_3), 4% cow urine (T_2) and control (T_1).

At 105 DAS, foliar application of cow urine + 50 ppm NAA (T_{10}) resulted in more dry matter 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), 25 ppm NAA (T_5) and 8% cow urine (T_4). Rest of the treatments 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1).

It is well known that the cow urine is the major source of nutrients like N, P, K, and growth hormones. Growth hormones also increases the uptake of nutrients from the soil (Sagare and Naphade, 1987). Hence, foliar application of cow urine with NAA enhanced significantly more dry weight in the present investigation when compared with control and individual application of cow urine or NAA.

Deotale *et al*. (2011) carried out a field experiment to determine the effect of two foliar sprays of different concentrations of NAA (50 ppm) and cow urine (2%, 4%, 6%) at 25 and 40 days after sowing on soybean cultivar JS-335. The experiment was laid out in FRBD with three replications with spacing of 30 cm x 10 cm in *kharif* (2005 to 2007). Observations on morpho-physiological parameters i.e., leaf area, dry matter production, plant height were recorded at 50 and 70 DAS. Pooled analysis was done after completion of three years experiment. Considering the cow urine concentrations 6% cow urine spray and 50 ppm NAA alone and in combination were found more effective in enhancing the morpho-physiological parameters when compared with 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 and pod filling. 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 the plant $unit^{-1}$ of leaf area. Foliar application of nutrients and hormones might have resulted in more availability of N, P, K which causes improvement in RGR and NAR.

Significantly maximum RGR was noted in 4% cow urine + 50 ppm NAA (T_{10}) treatment i.e 0.0916 g g^{-1} day^{-1}, while it was lowest in control i.e. 0.0652 g g^{-1} day^{-1} at 45-65 DAS. Treatment 4% cow urine + 50 ppm NAA (T_{10}) gave more RGR 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), 8% cow urine + 25 ppm NAA (T_9) and 50 ppm NAA (T_6) respectively when compared with control and rest of the treatments under study. 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) in RGR.

At 65-85 DAS data gave significant variation in respect of RGR. Significantly more RGR was recorded in treatment i.e. 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}). 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 85-105 DAS significantly maximum RGR was observed 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), 50 ppm NAA (T_6), 25 ppm NAA (T_5) and 8% cow urine (T_4). Rest of the treatments i.e. 6% cow urine (T_3) and 4% cow urine (T_2) were found at par with control (T_1).

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. At 45-65 DAS significantly maximum NAR was observed in treatments 4% cow urine + 50 ppm NAA (T_{10}) and 6% cow urine + 50 ppm NAA (T_{11}) followed by treatments 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). 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).

At 65-85 DAS 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) also gave significantly more NAR over control (T_1) in a descending manner. 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) in a descending manner.

At 85-105 DAS significantly maximum NAR was observed in treatment 4% cow urine + 50 ppm NAA (T_{10}) when compared with control and rest of the treatments. Similarly 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), 8% cow urine +25 ppm NAA (T_9), 50 ppm NAA (T_6) and 25 ppm NAA (T_5) also resistered significantly maximum NAR over control and rest of the treatments. Treatments 8% cow urine (T_4), 6% cow urine (T_3) and 4% cow urine (T_2) also showed their significance over 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 NPK, leaf chlorophyll content, RGR and NAR in mustard.

Seed yield ha^{-1}

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.