INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

IJPAES

Volume-4, Issue-1, Jan-Mar-2014

ISSN 2231-4490

Coden : IJPAES www.ijpaes.com

Received: 08th Jan-2014 *Revised: 13th Jan-2014* *Accepted: 17th Jan-2014*

Research article

NITROGEN RESPONSE, NUTRIENT UPTAKE BY THE CROP AND POST HARVEST SOIL FERTILITY STATUS IN SPECIALIATY CORN AS INFLUENCED BY NITROGEN FERTILIZATION UNDER *PONGAMIA* + MAIZE AGRISILVI SYSTEM

C. Prathyusha[1], S. Hemalatha[2], V. Praveen Rao[3] and G. Jayasree[4]

[1]Dept. of Agronomy, College of Agriculture, Rajendranagar, Hyderabad-500030, AP, India. Email id: prathyushareddy.162@gmail.com

[2]Farmers' Call Centre, ANGR Agricultural University, Hyderabad-500061; AP, India. Email id: hemalathasingana@gmail.com.

[3]Water Technology Centre, ANGR Agricultural University, Hyderabad-500030, AP, India.

[4]Dept. of Soil Science and Agricultural Chemistry, ANGR Agricultural University, College of Agriculture, Rajendranagar, Hyderabad-500030, AP, India.

ABSTRACT: A field experiment was conducted during *kharif* 2011 at the Student's Farm, College of Agriculture, Rajendranagar, Hyderabad on red sandy loam soils to study the effect of nitrogen management in speciality corn under *Pongamia* + maize agri-silvi system. Post harvest soil available nitrogen was significantly higher in all the treatments than control. Where as, maximum available N and K in soil was recorded with 120 kg N ha^{-1}. Though available P in soil observed under 120 kg N ha^{-1} was maximum, it was statistically at par with 90 kg N ha^{-1}. Post harvest soil available nutrients (N, P & K) were found unaffected by the different types of corn. Similarly, the maximum nutrient uptake (N, P & K) was also registered at 120 kg ha^{-1}, which was significantly higher than 60 and 90 kg N ha^{-1}. Sweet corn recorded significantly higher nitrogen uptake than the other two types of corn. Likewise, P & K uptake was also maximum in sweet corn but statistically on par with baby corn regarding P uptake and with popcorn regarding K uptake. The nitrogen response decreased gradually with increase in levels of nitrogen from 60 to 120 kg N ha^{-1} in all the types of corn. The maximum nitrogen response was observed with 60 kg ha^{-1}. Whereas, minimum nitrogen response was resulted with 120 kg ha^{-1}.

Key words: Nitrogen, Baby corn, Sweet corn, Popcorn.

INTRODUCTION

Arable cropping enterprise in drylands is often unremunerative on account of aberrations of monsoon. The major constraints that limit crop production in dryland areas are moisture and nutrient stress. Conservation of soil moisture and improvement of soil fertility through addition of organic materials may improve production from these lands considerably by sustaining the soil health. Hence an integrated approach of land management to utilize the natural resources more efficiently in rainfed areas is essential to meet the requirements of farmer and his live stock without deteriorating the land productivity and also generate continuous and stable income. One of the need based alternative land use system replacing the traditional farming system is a tree based system of cropping *i.e.*, agroforestry which acts as sustainable land management system especially in dryland areas. *Pongamia pinnata* is a multipurpose tree species (MPTS) and it is a good nitrogen fixing tree also. This tree species is sustainable under agro forestry farming system because of its fast growth and nitrogen fixation. It is the best suited tree for energy plantations. Since the gestation period is high in *Pongamia* and because of wider spacing between the trees the interspaces can be effectively used for intercropping. Maize (*Zea mays L.*) ranks next only to wheat and rice as it is considered as third most important cereal crop in the world.

Maize has been an important cereal crop because of its greater productivity potential and adaptability to wide range of agro climatic conditions. It can be called as "Natural Agricultural Resource" after sugar cane. Of the special types of maize, sweet corn, baby corn and pop corn are the most important. Baby corn is grown for vegetable purpose. Sweet corn is used as a human food in soft dough stage with succulent grain and 13 to 15 per cent sugar. It is gaining popularity because of its high sugar and low starch content. It has emerged as an alternative dish of urbanites viz., vegetable, roasted ears, soups, corn syrup, sweeteners *etc*. The other type *i.e.,* pop corn is very popular snack food in many parts of the world. The use of popcorn confectionaries and popcorn products especially in amusement parks, moving picture theaters etc greatly increased the demand for popcorn products and have made a profitable outlet for those who desire to grow popcorn on a commercial scale. Maize is a highly exhaustive crop and responds to higher levels of nitrogen. Hence for improved production of these corns efficient nitrogen management is needed besides sustaining soil health. Thus an integrated approach of using agroforestry and inorganic fertilizers to supplement N is promoted.

MATERIAL AND METHODS

The experiment was conducted at Student's Farm, College of Agriculture, Rajendranagar, Hyderabad on red sandy loam soils of Southern Telangana Agro-climatic Zone of Andhra Pradesh. The Farm is geographically situated at an altitude of 542.3 m above mean sea level at 170 19' N latitude and 780 28' E longitude. The soil of the experimental field was sandy loamy in texture(coarse sand-34.3%, sand-36.8%, silt-16.2% and clay-12.7 %), slightly alkaline in reaction (pH 7.2), Electrical conductivity (0.11 ds m^{-1}), low in organic carbon (0.52%) and nitrogen (121.4 kg ha^{-1}) and medium in available phosphorus (48.2 kg ha^{-1}) and available potassium (343.8 kg ha^{-1}). A total rainfall of 466.1 mm was received in 29 rainy days during the crop growth period. The distribution of rainfall was uniform and sufficient for better crop growth. The experiment was laid out in a randomized block design (factorial concept) with three replications. The treatments consists of three nitrogen levels (60, 90 and 120 kg N ha^{-1}) and three types of corn (baby corn, sweet corn and popcorn) as intercrops in *Pongamia* and one control treatment (sole *Pongamia* without maize and with no nitrogen). The entire quantity of P_2O_5 (i.e., 60 kg ha^{-1}) and K_2O (i.e., 40 kg ha^{-1}) was applied as basal at the time of sowing and N was applied in three splits, as basal, at knee-high and tasseling stages. The test varieties under study were **"**VL Baby Corn1", "Win Orange Sweet Corn" and "Amber popcorn". The spacings adopted were 50 cm x 15 cm in baby corn and 60 x 25 cm in both sweet corn and popcorn.

RESULTS AND DISCUSSION

Nitrogen Response

The nitrogen response decreased gradually with increase in levels of nitrogen from 60 to 120 kg N ha^{-1} in all the types of corn (Table 1). The maximum nitrogen response was observed with 60 kg ha^{-1} (56.45 & 106.36 kg of cob per kg of nitrogen applied in baby corn and sweet corn respectively and 22.13 kg of grain per kg of nitrogen applied in popcorn). Whereas, minimum nitrogen response was resulted with 120 kg ha^{-1}. Similar results were reported by Spandana [7].

Table 1. Nitrogen response of speciality corn as influenced by different levels of nitrogen

Treatment combinations	Nitrogen response (kg of cob or kg of grain per kg of nitrogen)
C_1N_1	56.45
C_1N_2	47.38
C_1N_3	38.96
C_2N_1	106.36
C_2N_2	78.81
C_2N_3	62.97
C_3N_1	33.24
C_3N_2	23.20
C_3N_3	22.13

C_1 – Baby corn N_1 – 60kg ha^{-1} C_2 – Sweet corn N_2 – 90kg ha^{-1} C_3 – Popcorn N_3 – 120kg ha^{-1}

*Data not analysed statistically.

Nutrient Uptake by the Crop

Nutrient uptake by speciality corn tended to increase with increased levels of nitrogen from 60 to 120 kg N ha^{-1}, with significant disparity between any two successive levels in case of all the three nutrients (nitrogen, phosphorous and potassium). Maximum nitrogen uptake was recorded with 120 kg N ha^{-1} (76.1 kg ha^{-1}), while the minimum was with 60 kg N ha^{-1} (59.7 kg ha^{-1}) (Table 2.). With the comfortable nitrogen nutrition, crop might have developed larger rhizosphere exploring more volume of soil and extracting larger quantity of nitrogen and transporting to planosphere, thus enhancing the nutrient content in the vegetative parts and translocating considerable fraction to the cobs. The similar findings have also been reported by Kar [4], Sahoo and Mahapatra [5] Ashok Kumar [2]. Maximum phosphorous uptake was recorded with 120 kg N ha^{-1} (27.6 kg ha^{-1}) which was significantly higher than the other two nitrogen levels (Table 2.). The higher phosphorous uptake at higher level of nitrogen was mainly attributed to the higher dry matter production at that level of nitrogen. These results are in accordance with those of Singh [6] and Kalyani [3]. Application of nitrogen at 120 kg ha^{-1} (107.2 kg ha^{-1}) recorded significantly higher potassium uptake than the other two nitrogen levels tried which in turn had significant disparity between them (Table 2.). This might be due to the efficient absorption of mineral nutrients coupled with higher dry matter production under higher nitrogen levels. Similar results have also been reported by Spandana [7] and Kalyani [3]. Nitrogen uptake in different types of corn showed that, sweet corn (71.0 kg ha^{-1}) recorded significantly higher nitrogen uptake than the rest of the corn types which were comparable with each other (66.5 and 65.7 kg ha^{-1} in baby corn and popcorn respectively) (Table 2.). Regarding phosphorous uptake, sweet corn was found significantly superior over the rest of corn types which were statistically on par with each other (24.3, 26.4 & 22.8 kg ha^{-1} in baby corn, sweet corn and popcorn respectively) (Table 2.). Potassium uptake in case of sweet corn and baby corn were found significantly different from each other. Whereas, the rest of corn type combinations were found comparable with each other in potassium uptake by the crop (92.1, 102.9 & 95.3 kg ha^{-1} in baby corn, sweet corn and popcorn respectively) (Table 2). This variations in different types of corns might be due to the genetic differences among themselves and due to the differences in their potentialities for different growth & yield characteristics. The interaction effect between types of corn and levels of nitrogen was found non-significant on nutrient uptake by speciality corn.

Table 2. NPK uptake (kg ha^{-1}) of speciality corn as influenced by varying nitrogen levels and types of corn

Nitrogen levels (kg ha^{-1})	Types of corn											
	Nitrogen				Phosphorus				Potassium			
	Baby corn	Sweet corn	Popcorn	Mean	Baby corn	Sweet corn	Popcorn	Mean	Baby corn	Sweet corn	Popcorn	Mean
60	59	61.6	58.7	**59.7**	21.4	23.2	19.5	**21.4**	82.2	91.1	84.2	**85.8**
90	66	70.5	65.5	**67.4**	24.7	26.1	22.7	**24.5**	93.0	103.0	95.9	**97.3**
120	74	81.0	73.0	**76.1**	26.9	29.8	26.2	**27.6**	101.2	114.8	105.6	**107.2**
Mean	**66.5**	**71.0**	**65.7**		**24.3**	**26.4**	**22.8**		**92.1**	**102.9**	**95.3**	
	S.Em±		CD (p = 0.05)		S.Em±		CD (p = 0.05)		S.Em±		CD (P = 0.05)	
Nitrogen levels (kg ha^{-1})	1.45		4.36		0.68		2.05		2.85		8.56	
Types of corn	1.45		4.36		0.68		2.05		2.85		8.56	
N x C	2.52		NS		1.18		NS		4.94		NS	

Post harvest soil fertility status

All the treatments showed significantly higher available nitrogen than control. The maximum post harvest soil available nitrogen was recorded with the nitrogen level 120 kg ha^{-1} (144.9 kg ha^{-1}), which was significantly higher than the other nitrogen levels studied. The next best nitrogen level was 90 kg ha^{-1} followed by 60 kg ha^{-1} and both of them were comparable between each other (Table 3.). Considerable quantity of nitrogen left over in the soil, might have remained in the soil after meeting the maximum requirement of the crop at higher levels of nitrogen applied. Similar results were also reported by Anil Kumar [1] and Kalyani [3]. All the treatments showed significantly higher available phosphorous and potassium than control. Application of nitrogen at 120 kg ha^{-1} (43.7 kg ha^{-1}) recorded significantly maximum post harvest soil available phosphorous compared to 60 kg N ha^{-1} but it was found at par with 90 kg N ha^{-1}(Table 3.). Whereas, available potassium in soil tend to increase with increased levels of nitrogen from 60 to 120 kg N ha^{-1}, with significant disparity between any two successive levels (Table 3.).

These results are in accordance with those of Sunitha [8], Spandana [7] and Kalyani [3]. The effect of types of corn on post harvest soil fertility status was found to be non significant. The interaction effect between types of corn and levels of nitrogen was also found non significant on post harvest soil fertility status.

Table 3. Available nutrient status of soil (kg ha^{-1}) after harvest of speciality corn as influenced by varying nitrogen levels and types of corn

Nitrogen levels (kg ha^{-1})	Types of corn											
	Available nitrogen				Available phosphorous				Available potassium			
	Baby corn	Sweet corn	Popcorn	Mean	Baby corn	Sweet corn	Popcorn	Mean	Baby corn	Sweet corn	Popcorn	Mean
60	119.7	124.3	128.3	**124.1**	38.9	40.3	41.7	**40.3**	309.4	298.4	300.6	**302.9**
90	126.0	138.6	132.3	**132.3**	40.7	41.2	43.2	**41.7**	317.6	321.6	337.8	**325.6**
120	138.6	144.9	151.2	**144.9**	41.0	45.4	44.8	**43.7**	325.9	333.9	340.3	**333.3**
Mean	**128.1**	**135.9**	**137.2**		**40.2**	**42.3**	**43.2**		**317.6**	**317.9**	**326.2**	
	S.Em±		CD (p = 0.05)		S.Em±		CD (p = 0.05)		S.Em±		CD (P = 0.05)	
Nitrogen levels	4.65		9.13		1.25		2.45		6.50		12.74	
Types of corn	4.65		NS		1.25		NS		6.50		NS	
N x C	8.06		NS		2.17		NS		11.26		NS	

Control (sole *Pongamia* without maize) – 101.9 - 38.9 - 292.6 (available NPK respectively).
Control Vs Treatments – Significant (significance was tested by F test)

REFERENCES

[1] Anilkumar., Thakur, K. S and Sandeep Manuja. 2002. Effect of fertility levels on promising hybrid maize (*Zea mays*) under rainfed conditions of Himachal Pradesh. Indian Journal of Agronomy. 47(4):526-530.

[2] Ashok Kumar. 2009. Influence of varying plant population and nitrogen levels on growth, yield, economics and nitrogen use efficiency of popcorn (*Zea mays* everta sturt). Crop Research. 37 (1, 2 & 3): 19-23.

[3] Kalyani, D.L. 2011. Agro - techniques for higher yield and quality of popcorn (*Zea mays l. indurata*). *Ph. D Thesis*. Acharya N.G. Ranga Agricultural University, Hyderabad, India.

[4] Kar, P.P., Barik, K.C., Mahapatra, P.K., Garnayak, L.M., Rath, B.S., Bastia, D.K and Khanda, C.M. 2006. Effect of planting geometry and nitrogen on yield, economics and nitrogen uptake of sweet corn *(Zea mays*). Indian Journal of Agronomy. 51 (1): 43-45.

[5] Sahoo, S.C and Mahapatra, P.K. 2007. Response of sweet corn (*Zea mays*) to plant population and fertility levels during *Rabi* season. Indian Journal of Agricultural Sciences. 77 (11): 779-781.

[6] Singh, M.K., Singh, R.N., Singh, S.P., Yadav, M.K and Singh, V.K. 2010. Integrated nutrient management for higher yield, quality and profitability of baby corn (*Zea mays*). Indian Journal of Agronomy. 55 (2): 100-104.

[7] Spandana, B. 2010. Response of sweet corn hybrid to varying plant densities and nitrogen levels. *M.Sc (Ag) Thesis*. Acharya N.G. Ranga Agricultural University, Hyderabad, India.

[8] Sunitha, N. 2007. Agrotechniques for higher yield and quality of sweet corn (*Zea mays* L.) in the Southern Agroclimatic zone of Andhra Pradesh. *Ph. D Thesis*. Acharya N.G. Ranga Agricultural University, Hyderabad, India.