Annals of Arid Zone 55(1&2): 35-39, 2016

Effect of Different Sources of Nitrogen on *Kachari* (*Cucumis melo*) Performance in the Arid Region

M.K. Jatav*, B.D. Sharma, D.K. Samadia and S.R. Meena

ICAR-Central Institute for Arid Horticulture, Bikaner 334 006, India

Received: May 2016

Abstract: The field experiment was conducted at Central Institute of Arid Horticulture (CIAH), research farm with popular *kachari* cultivars AHK119 during 2015 in the kharif season to investigate the effect of different sources of nitrogen on *kachari* performance. Different source of N showed significant effect on growth attributes, as well as yield and nutrients uptake by *kachari*. 80 kg N ha^{-1} through neem coated urea as spilt application proved to be more effective in terms of growth attributes, *kachari* yield, nutrients uptake and recoveries. Neem coated urea application was more superior than calcium nitrate and urea.

Key words: *Cucumis melo,* nitrogen, neem coated.

To achieve nutrition and income security for the people, particularly in hot arid region of north-western parts of Rajasthan, suitable crop-plant species from vegetables are of vital importance. The native crops like *kachari* support livelihood in the hostile situations, where vegetable crop diversification is not much feasible. However, limited attention was paid for its nutrient management and other agronomic aspects. *Kachari* requires hot and dry climate and a long growing season preferably with warmer days for cultivation both as rainy and summer season crop. The high temperature and dryness conditions are beneficial for crop, fruit maturity and quality and are also best for dehydration of *kachari* fruits. *Kachari* variety AHK-119 fruits are small, egg shaped weighing 50-60 g. Fruits are ready for picking in 68-70 days after sowing, 22 fruits per vine, and yields of 95-100 q ha^{-1}.

The crop production in the hot arid regions are constrained by low and erratic rainfall (100-420 mm $year^{-1}$), high evapo-transpiration (1500-2000 mm $year^{-1}$) and poor in soil fertility. Arid region soils are low in organic matter, macronutrient and micronutrient (Shyampura *et al.*, 2002; Rathore, 2009; Yadav and Meena, 2009; Yadav, 2011; Chattopadhyay *et al.*, 1997; Singh, 2006; Singh, 2008; Mahesh Kumar *et al.*, 2011). The low organic matter has been attributed to high temperature, low rainfall, scanty vegetation and single grained structure of soil.

*E-mail: mkjatav2008@gmail.com

Nitrogen is one of the most important and essential nutrient which directly influences the growth, development, yield and quality of crop. Nitrogen is universally deficient in majority of the agricultural soils and successful arable farming is impossible without the use of nitrogenous fertilizers. Moreover, nitrogen fertilization aims at a high economic return of the investment through optimized crop yield and quality. Although, nitrogen is from a quantitative point of view, the most important nutrient in crop production in comparison with phosphorus and potassium, its efficiency is low for crop production. Nitrogen fertilizers upon application to soil are subjected to numerous reactions, transformations and N loss mechanisms such as ammonia volatilization, nitrification and subsequent denitrification, leaching, chemical and microbial immobilization and surface runoff. Thus quite a high proportion of the applied N is lost one way or the other. As a result, N use efficiency for crop production is discouragingly low (Roy and Chandra, 1979; Zia and Waving, 1987). In view of the high cost of nitrogen fertilizer, it is important to improve the N utilization efficiency for crop production with the objective to reduce cost of crop production.

Nutrients requirement of *kachari* differ with soil, climate, cultivar and growth period. Nutrients use efficiency is low in *kachari* in the hot arid region. In view of the high cost of nitrogen fertilizer, it is important to improve the N utilization efficiency for crop production with

the objective to reduce cost of crop production to attain higher levels of *kachari* productivity along with maintaining the fertility of the soil. Research works on nutrient management for *kachari* crop is scanty. However, information on response of neem coated urea has not been generated so far.

Materials and Methods

The field experiment was conducted at CIAH, research farm with popular *kachari* cultivars AHK119 in the kharif season to investigate the effect of different sources of nitrogen on *kachari* performance. The soil was sandy, alkaline in reaction with pH 8.4, low in organic carbon (0.11%) and available (N 110 kg ha^{-1}), medium in available P 12 kg ha^{-1} and high in available K (320 kg ha^{-1}). The *kachari* crop received N from different N containing fertilizers as per schedule of treatments. The seven treatments consisting of control, 80 kg N ha^{-1} through calcium nitrate, 80 kg N ha^{-1} through urea, 80 kg N ha^{-1} through neem coated urea (entire dose at time of planting), 80 kg N ha^{-1} through calcium nitrate (spilt application of N), 80 kg N ha^{-1} through urea (spilt application of N) and 80 kg N ha^{-1} through neem coated urea (spilt application of N). *Kachari* cultivars AHK119 was sown with hand plough at spacing 2 m x 50 cm row-to-row and plant to plant distance. The recommended dose of P (60 kg of P_2O_2) and K (60 K_2O ha^{-1}) was applied as basal through single superphosphate and MOP. Nitrogen was given as per treatments. Other cultural practices were applied uniformly as per recommendation for the crop in the area. Life saving irrigation was applied during long dry spells. Five random plants were selected from each plot excluding the border row for taking observation on growth and yield attributes.

Kachari sample from each plot were washed with 0.1 N HCI solution to remove the dust and spray particles were removed and then rinsed with distilled water. The samples were dried in hot air oven at 60°C and ground. N content in plant samples were determined by Kjeldahl method. Data was statistically analysed by the procedure described by Gomez and Gomez (1984).

For working out net return *kachari*, price of *kachari* was taken as Rs. 2000 q^{-1}. Agronomic efficiency (AE), physiological efficiency (PE), apparent recovery (AR %) and per cent yield response were computed using the *kachari* yield data, rates of fertilizer nutrients applied and total uptake by *kachari* as.

(1) Agronomic efficiency (AE):
$$\frac{\text{Kachari yield in fertilized plot - Kachari yield in unfertilized plot}}{\text{Quantity of total nutrient applied}}$$

(2) Physiological efficiency (PE):
$$\frac{\text{Kachari yield in fertilized plot - Kachari yield in unfertilized plot}}{\text{Uptake in fertilized plot - Uptake in unfertilized plot}}$$

(3) Apparent recovery (AR%):
$$\frac{\text{Uptake in fertilized plot - Uptake in unfertilized plot}}{\text{Quantity of total nutrient applied}}$$

(4) Yield response:
$$\frac{\text{Yield in fertilized plot - Yield in unfertilized plot}}{\text{Yield in unfertilized plot}}$$

Results and Discussion

Growth and yield of kachari

Vine length (cm), fruit production $plant^{-1}$ (gm), no. of fruits $plant^{-1}$ and No. of branches $plant^{-1}$ were showed significant effect of different sources of N application (Table 1). Maximum vine length (cm), fruit production $plant^{-1}$ (gm), no. of fruits $plant^{-1}$ and No. of branches

Table 1. Role of different sources of nitrogen on growth attributes of kachari

Treatments	Vine length (cm)	No. of branches $plant^{-1}$	No of fruits $plant^{-1}$	Fruit production $plant^{-1}$ (gm)
Control	1.5	5.2	13	560
80 kg N ha^{-1} through CAN	1.9	7.9	18	648
80 kg N ha^{-1} through urea	1.7	6.1	15	510
80 kg N ha^{-1} through neem coated urea	2.3	8.4	22	946
80 kg N ha^{-1} through CAN (spilt application of N)	2.1	7.3	25	950
80 kg N ha^{-1} through urea (spilt application of N)	2.4	8.8	23	828
80 kg N ha^{-1} through neem coated urea (spilt application of N)	2.6	9.6	28	1036
CD at 5%	0.35	1.15	3.45	124.25

plant^{-1} (1.5, 5.2, 13 and 560, respectively) was observed with spilt application of N @ 80 kg N ha^{-1} through neem coated urea followed by 80 kg N ha^{-1} through neem coated urea as entire dose at time of sowing. Different sources of N containing fertilizers increased yield of *kachari* as compared to control (Table 1 and 2). Spilt application of N @ 80 kg N ha^{-1} through neem coated urea gave higher growth parameters like vine length, No. of branches, fruits plant^{-1} and fruit production plant^{-1} followed by spilt application of N through calcium nitrate and spilt application of N @ 80 kg N ha^{-1} through urea. Spilt application of N @ 80 kg N ha^{-1} through neem coated urea gave maximum yield (109.25 q ha^{-1}) followed by spilt application of N through calcium nitrate (102.65 q ha^{-1}) and spilt application of N @ 80 kg N ha^{-1} through urea (98.25 q ha^{-1}).

The increase in total yield was 97.74% higher over control by spilt application of N @ 80 kg N ha^{-1} through neem coated urea. Application of N through urea also increased yield significantly by 77.83% compared to control. Whereas, this treatment gave only 11.19% less *kachari* yield as compared to spilt application of N @ 80 kg N ha^{-1} through neem coated urea.

Nutrient uptake and apparent recovery

The uptake of N was significantly affected by different treatments (Table 2). Maximum uptake of N (18.17 kg ha^{-1}) by *kachari* was obtained with 80 kg N ha^{-1} through Neem coated urea (spilt application of N) followed 80 kg N ha^{-1} through calcium nitrate as spilt application of N (17.32 kg ha^{-1}). Since the 80 kg N ha^{-1} through neem coated urea (spilt application of N) resulted in increased yield and yield attributes of *kachari* so the uptake values of above nutrients also registered a simultaneous increase. The apparent recovery is the increase in the quantity of nutrient absorbed over control per unit nutrient applied. The increase in nutrient uptake was reflected in the enhanced recoveries of applied fertilizer N with the application of N through sources and methods (Fig. 1). Maximum apparent recovery was observed by the application of 80 kg N ha^{-1} through neem coated urea as spilt application (13.03%) followed by 80 kg N ha^{-1} through calcium nitrate as spilt application (11.97%) and urea (11.14%). Spilt application was superior than basal application. This may be due to beneficial effect of neem coated urea in the soil which in turn makes sufficient N in soil solution around root zone as indicated by the higher N recoveries. This situation definitely increased plants uptake of nutrients and growth. Ogbodo *et al*. (2010) reported that plants with more vigorous growth and larger plant size which normally increases photosynthetic efficiency and yield. Application of neem cake coated urea increased the percent nitrogen content and uptake of nitrogen (Jat and Pal 2002; Kumar and Prasad, 2004).

Physiological and agronomic efficiency

Physiological efficiency is the increase in *kachari* production obtained per unit increase in nutrient absorbed over control, whereas, agronomic efficiency is the increase economic yield obtained per unit increase in nutrient applied. Physiological and agronomic efficiency by *kachari* crop were significantly influenced by the various source of N fertilizers. Maximum

Table 2. Role of different sources of nitrogen on performance of kachari

Treatments	Yield (q ha^{-1})	Yield response (%)	N uptake (kg ha^{-1})	AE (kg kg^{-1} N)	AR%	PE (kg kg^{-1} N)
Control	55.25	-	7.74	-	-	-
80 kg N ha^{-1} through calcium nitrate	89.20	61.45	14.44	42.44	8.38	506
80 kg N ha^{-1} through urea	82.45	49.23	13.29	34.00	6.94	490
80 kg N ha^{-1} through neem coated urea	95.78	73.36	15.54	50.66	9.75	520
80 kg N ha^{-1} through calcium nitrate (spilt application of N)	102.65	85.79	17.32	59.25	11.97	495
80 kg N ha^{-1} through urea (spilt application of N)	98.25	77.83	16.65	53.75	11.14	483
80 kg N ha^{-1} through neem coated urea (spilt application of N)	109.25	97.74	18.17	67.50	13.03	518
CD at 5%	14.21	74.23	0.82	-	-	-

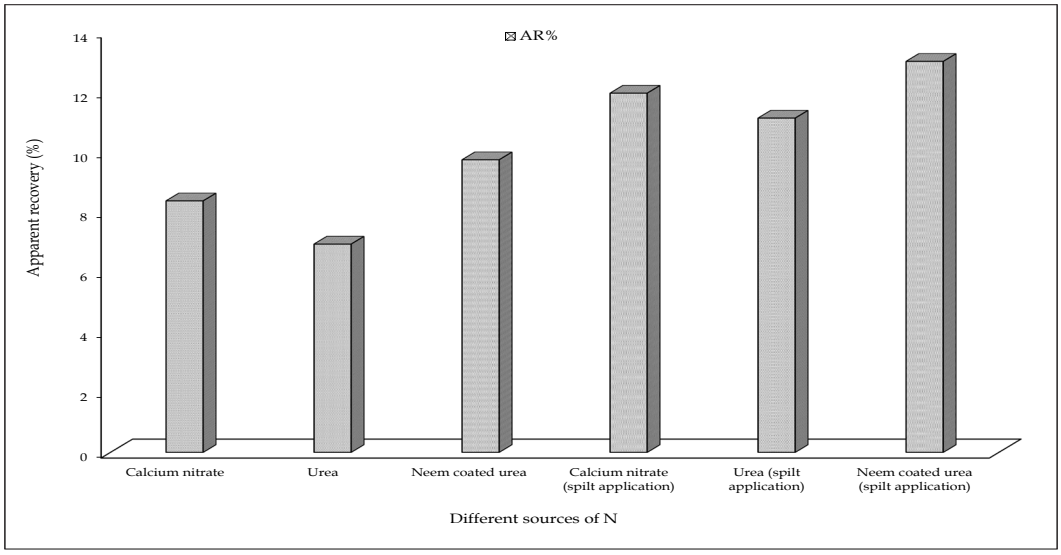

Fig. 1. Different sources of nitrogen (80 kg N ha^{-1}) on apparent recovery of N by kachari.

physiological efficiency of N (518 kg kg^{-1}) was obtained when N applied through 80 kg N ha^{-1} through neem coated urea as spilt application (Fig. 2), which was followed by application of N @ 80 kg N ha^{-1} through neem coated urea (entire dose at time of planting). Whereas, 80 kg N ha^{-1} through calcium nitrate as basal and 80 kg N ha^{-1} through calcium nitrate as spilt application gave 506 and 495 kg kg^{-1} of N, respectively.

This clearly indicated that in the treatments where N ha^{-1} through neem coated urea fertilizer, crop was able to convert the absorbed nutrients particularly N in economic yield in a better way. Lowest physiological efficiency of N was observed in treatment where N through urea was applied indicating that due to absorbed N could not be converted in the yield. Therefore, their physiological efficiency was the lowest when urea fertilizer was applied. The apparent agronomic efficiency of fertilizer N increased with the different sources of N (Fig. 2). The maximum efficiency was observed when 80 kg N ha^{-1} through neem coated urea as spilt application (67.50 kg kg^{-1} N) followed by 80 kg N ha^{-1} through calcium nitrate as spilt application (59.25 kg kg^{-1} N). This was also due to increased availability of N nutrient through neem coated urea. The treatment receiving neem coated urea recorded significantly higher efficiencies than other treatments this could be due to prolonged availability of nitrogen in the treatment (Sannagoudra *et al.,* 2012).

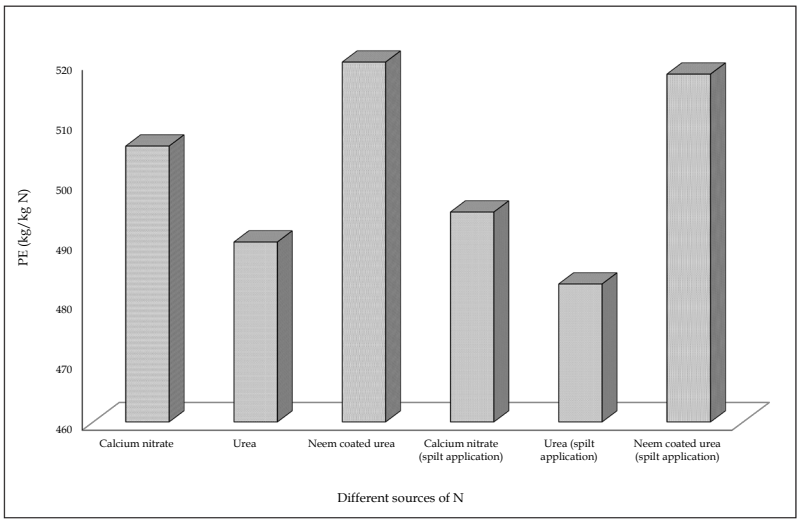

Fig. 2. Different sources of nitrogen (80 kg N ha^{-1}) on physiological efficiency of kachari.

Conclusion

From this study it can be concluded that under hot arid agro-climate where soil is low in organic matter and available plant nutrients are of great importance in increasing yield by the balanced plant nutrients supply. Application of neem coated increased the yield and nitrogen uptake. It may concluded that neem coated urea gave higher yield. Besides more yield, this treatment also showed increasing efficiency, net return and B:C ratio.

Acknowledgements

Authors are grateful to Dr. S.K. Sharma, Director, ICAR-Central Institute for Arid Horticulture, Bikaner for his keen interest and for providing facilities for this investigation.

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Printed in June 2016