ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor: 8.4
IJAR 2022; 8(7): 33-35
www.allresearchjournal.com
Received: 09-04-2022
Accepted: 17-06-2022

Kakde GC
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

VD Patil
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

PH Gourkhede
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Corresponding Author:
Kakde GC
Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Nutrient use efficiency in terms of yield and uptake as influenced by multinutrient briquettes in bt-cotton grown on vertisol

Kakde GC, VD Patil and PH Gourkhede

Abstract
The field experiments were conducted during 2015-16 and 2016-17, at research farm of Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* to study the Economics of Bt-cotton as influenced by application of multinutrient briquettes (NPKZn) through soil with drip irrigation. The experiment was laid out in a Randomized Block Design with five treatments [(T_1: Absolute Control (No fertilizer application), T_2: Soil application of 120:60:60 by N, P_2O_5, K_2O kg ha^{-1} and Drip irrigation, T_3: RDF through fertigation (soluble fertilizer: 80:40:40 NPK kg ha^{-1}), T_4: 120: 60: 60 kg NPK ha^{-1} through briquettes with drip irrigation, T_5: Application of NPK+ micronutrient briquettes (120:60: 60 NPK kg ha^{-1} +20 kg ha^{-1} $ZnSO_4$)] with four replications. The results of the investigation indicated that the application of NPKZn briquettes coupled with drip irrigation found to be effective in increasing the seed cotton yield. The uptake of nutrient was increased with advancement of crop growth. The maximum macro and micro nutrient use efficiency (i.e. NPK and Zn) obtained in NPKZn briquettes coupled with drip irrigation while minimum in absolute control was due to low yields.

Keywords: Nutrient use efficiency, multinutrient briquettes, yield, Bt-Cotton, vertisol

Introduction
Increasing nutrient use efficiency (NUE) is critical in order to achieve expected production while using as little fertilizer as possible. The use of the proper fertilizer in the right amount is one of the most important management strategies for increasing fertilizer efficiency (Fageria *et al*., 2016) [3] and maximize crop productivity Moreover, right combination of primary nutrients is also important to enhance wheat yield and NUE. In crops, the global N use efficiency was found to be 33% (Raun *et al*.,1999) [14]. NUE declines with increased N dose while crop production increases. Hail *et al.*, (2012) [6] reported a lower nitrogen use efficiency (27.1%) from a nitrogen rate of 120 kg N ha^{-1} compared to a nitrogen rate of 30 kg N ha^{-1} with 39.27% nitrogen use efficiency. One of the reasons for lower nitrogen efficiency is N losses, limits only 50% of applied nitrogen fertilizer available to cereal crops. The global P use efficiency was reported to be 16% in crops. Most agricultural crops recovered 20–30% of applied P during their growth under suitable growing environments (Dobermann *et al*., 2007). Under ideal conditions, an achievable range of 40–60% potassium recovery efficiency has been recorded in crops cultivated in soils with low potassium content. Nutrient use efficiency of micronutrientis very low in zincit is just 2 to 5%, (Tiwari *et al.*, 2012) [16] Aside from the individual effects of nutrients, the interaction of nutrients is also crucial for yield and nutrient efficiency. Nitrogen aids in the efficient utilization of potassium, phosphorus, and other nutrients by plants (Brady *et al*.,1984) [1]. N and P use efficiency, as well as productivity and quality of agriculture produce, could all benefit from increased K fertilization.

Cotton (*Gossypium spp*.) is one of the most important commercial, non-edible commodity, produced on India's farms playing a key role in the economical and social status of world. The country ranks first in cotton area and second in cotton production in the world. About 15 million farmers in the country spread across 10 states are engaged in cotton production i.e Gujarat, Maharashtra, Haryana, Punjab, Rajasthan, Madhya Pradesh, Andhra Pradesh, Karnataka and Tamilnadu are considered the major cotton growing states in India.

It is grown on an area of 11.76 million hectares, which constitutes around 38% of the world area under cotton cultivation. To minimize such losses and to reduce the import demand as well as increasing the efficiency of fertilizers, deep placement of slow release nitrification inhibitors are recommended. The use of urea briquettes is another development in this direction. (More and Shinde, 2000) [12]

Briquettes are entirely mineral in their formulation and are manufactured by a fertilizer briquetter machine. Surface applied urea is reported to reach N losses as high as 35% however, buried briquettes only lose approximately 4% of its N, which is a considerable improvement in N use efficiency (IFDC, 2013) [8]. Urea briquette which is used now-a-days supply only N as in few cases urea-DAP briquette supply N and P. It would be beneficial if all three *viz*. P and K with deficient micronutrient Zn nutrient are supplied in the form of briquette. It is also essential to test this type of product i.e. multi-nutrient briquette having N, P, K and Zn. It was noticed that almost no work was reported on production and application of multinutrient briquettes supplying N, P, K and Zn in cotton crop under Vertisols and hence need rises of conducting the underlined experiment. The efficiency of NPK fertilizer however is low as reported by many researchers. Single grained fertilizer expose more surface area while the one briquette comprising of about 2.7 gm of fertilizer expose relatively very less surface area of nutrient present in briquette.(Sawant *et al.*,2010) [15].This helps in reduced leaching and volatilization losses of nutrient thereby increase use efficiency by crops and this improved nutrient use efficiency will not only help to lower the cost of crop production by reducing fertilizer use, but also help to reduce fertilizer contamination (Good *et al.*, 2007) [5]. Despite the fact that using less fertilizer increases nutrient use efficiency, farmers are concerned about optimizing profit (Ghosh *et al.*, 2015) [4]. So, it's essential to find a balance between nutrient efficiency and crop productivity. To address these gaps, this study aims to find best combination of nitrogen, phosphorous, potassium and zinc as well as nutrient use efficiency in wheat for improve nutrient management strategy in Bt-Cotton.

Materials and Methods

The field experiment was carried out using Bt-Cotton (*Var*.Ajeet-199) in *Monsoon* season during years 2015-16 and 2016-17 on Typic haplusterts at Research Farm of Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. In project multinutrients briquettes containing N,P,K and Zn were produced by Kranti Briquetter machine by using Urea, DAP, MOP and $ZnSO_4$ as per the recommended dose (120:60:60 NPK kg ha^{-1}) of Bt-cotton crop. Each briquette weighed 2.75 gms. Further the briquettes were placed below the 5 cm soil surface and 10 cm away from the dibbled cotton seed.(T_1)Absolute Control (No fertilizer application), (T_2) Soil application of 120:60:60 by N, P_2O_5, K_2O kg ha^{-1} and Drip irrigation,(T_3)RDF through fertigation (soluble fertilizer: 80:40:40 NPK kg ha^{-1}), (T_4)120: 60: 60 kg NPK ha^{-1} through briquettes with drip irrigation, (T_5) Application of NPK + micronutrient briquettes (120:60: 60 NPK kg ha^{-1} +20kg ha^{-1} $ZnSO_4$).

- **Production and placement of multinutrient Briquettes**

In the present research project multinutrients briquettes containing N, P, K and Zn were produced by Kranti Briquetter machine by using Urea, DAP, MOP and $ZnSO_4$ as per the recommended dose (120:60:60 NPK kg ha^{-1}) of Bt-cotton crop. Each briquette weighed 2.75 gms. Further the briquettes were placed below the 5 cm soil surface and 10 cm away from the dibbled cotton seed.

- **Nutrient use efficiency**

Nutrient use efficiency (NUE) is a term used to indicate the relative balance between the amount of nutrient used by the crop versus the amount of nutrient applied (i.e. N, P, K and Zn). As fertilizers were applied in different plots at different doses, the use efficiency of nutrient was calculated by the following formula.

$$\text{NUE} = \frac{\text{Total nutrient uptake by plant}}{\text{Amount of fertilizer applied} - \text{Residual amount of fertilizer}} \times 100$$

Results and Discussion

Effect of multinutrient briquettes on use efficiency NPKZn in Bt cotton

Effect of multinutrient briquettes on nutrient use efficiency is presented in (Table 1). The highest nitrogen use efficiency (75.82%) was observed with NPKZn briquettes coupled with drip irrigation. However, only NPK briquette through drip irrigation was accompanied by significantly reduction in nitrogen use efficiency. The lowest nitrogen use efficiency (36.4%) was observed with absolute control where no fertilizers applied. The multinutrients briquettes application affected phosphorous use efficiency significantly. Maximum phosphorous use efficiency (25.64%) was observed with NPKZn briquettes coupled with drip irrigation followed by application of soluble fertilizers through fertigation. Minimum phosphorous use efficiency (13.87%) was observed in treatment T_2 (RDF through soil application). Potassium use efficiency also differed significantly in plants treated NPKZn briquettes. Significantly higher potassium use efficiency (93.10%) was recorded in treatment T_5 i.e. NPKZn briquettes applied through drip irrigation followed by treatment T_3 (Soluble fertilizers through fertigation) i.e. 86.89%. The micronutrient use efficiency is very low. Zn use efficiency in T_5 i.e. NPKZn briquettes coupled with drip irrigation (5.65%). The use efficiency in case of application of briquettes increased due to nutrient losses due to leaching, volatilization and fixation and the activated risk of nitrate leaching after fertilizer addition to soil may be reduced through the use of slow release fertilizer in cotton crop a long duration and high yielding commercial crop consumes greater amount of nutrient from the soil as well as from applied fertilizers for prolonged period. Similar observations were recorded by Jagadeeswaran *et al.* (2005) [9], Husan *et al.* (2014) [7], Das *et al.*, (2015) [2] and More *et al.*, (2012) [13].

Table 1: Effect of multinutrient briquettes on Nutrient use efficiency (%) of Bt-cotton

Treatments		Nutrient use efficiency*			
		Nitrogen use efficiency	Phosphorus use efficiency	Potassium use efficiency	Zinc use efficiency
T1	Absolute Control (Drip irrigation)	-	-	-	-
T2	RDF (Soil)	45.59%	13.87%	35.73%	
T3	Soluble Fertilizers (fertigation)	74.90%	22.78%	86.89%	
T4	NPK Briquettes with Drip	58.69%	18.55%	63.75%	
T5	NPK + Zn Briquettes with Drip	75.82%	25.64%	93.10%	5.65%

(*-indicated the mean values of 2015-16 and 2016-17)

Conclusion

Knowledge of the appropriate fertilizer rate and crop nutrient requirements is critical for farmers to enhance crop yields and nutrient use efficiency. Improving nutrient efficiency is a noble goal as well as a serious issue for the agriculture and fertilizer business. The finding showed that NPKZn briquettes coupled with drip irrigation was the optimum recommendations with higher grain yield and efficient use of nutrients in Bt-Cotton. The reference value of nutrient use efficiency indices recorded in Bt-Cotton of Vertisol in this study can be used to quantify the crop response to applied nutrient and minimize nutrient losses for better management practice.

Table 2: Effect of Mutinutrient Briquettes on Yield and Uptake of Bt-Cotton

Treatments	Seed Cotton Yield (q ha^{-1})	Stalk Yield (q ha^{-1})	Total N uptake (kg ha^{-1})			Total P uptake (kg ha^{-1})			Total K uptake (kg ha^{-1})		Total Zn uptake (g kg^{-1})			
			Plant	Seed	Total	Plant	Seed	Total	Plant	Seed	Total	Plant	Seed	Total
T_1	11.51	57.96	7.44	38.57	42.58	1.93	3.68	5.61	16.50	10.02	26.52	366.76	409.27	776.02
T_2	12.81	65.83	9.86	43.41	48.89	2.87	4.23	7.09	24.13	14.09	38.21	543.80	483.26	1027.06
T_3	15.91	69.97	12.37	54.09	60.73	3.04	6.36	9.40	28.03	16.38	44.41	645.26	613.55	1258.81
T_4	15.49	68.52	14.92	49.95	57.24	4.48	6.23	10.71	32.40	16.37	48.77	813.57	562.45	1376.03
T_5	16.88	69.80	18.39	58.42	68.63	5.37	8.10	13.48	35.59	19.25	54.84	997.96	679.23	1677.19
S.Em (±)	0.82	2.91	0.62	2.80	6.24	0.14	0.59	0.38	0.74	0.90	1.13	30.70	92.39	44.17
CD at 5%	2.39	11.41	2.43	8.16	18.69	0.41	2.33	1.12	2.17	2.62	3.29	89.62	31.65	128.92

References

1. Brady NC, Weil RR. Soil reaction: acidity and alkalinity. The nature and properties of soils. Macmillan Publ. Co., New York, 1984, 189-222. [Google Scholar]
2. Das S, Islam MR, Sultana M, Afroz H, Hashem MA. Effect of deep placement of nitrogen fertilizers on rice yield and n use efficiency under water regimes. SAARC J Agri. 2015;13(2):161-172.
3. Fageria NK. The use of nutrients in crop plants. CRC press, 2016 Apr 19.
4. Ghosh BN, Singh RJ, Mishra PK. Soil and input management options for increasing nutrient use efficiency. Nutrient use efficiency: from basics to advances, 2015, 17-27. [Google Scholar]
5. Good AG, Johnson SJ, De Pauw M, Carroll RT, Savidov N, Vidmar J, *et al*. Engineering nitrogen use efficiency with alanine aminotransferase. Botany. 2007 Mar;85(3):252-62. [Google Scholar]
6. Haile D, Nigussie D, Ayana A. Nitrogen use efficiency of bread wheat: Effects of nitrogen rate and time of application. Journal of soil science and plant nutrition. 2012. Sep;12(3):389-410. [Google Scholar]
7. Husan MR, Islam MR, Faried K, Mian MH. Nitrogen use efficiency and rice yield as influenced by the application of prilled urea and urea super granule with or without organic manure J Bangladesh Agril. Univ. 2014;12(1):37- 43.
8. International Fertilizer Development Center, 2013.Webpage: http:/www. Ifdc.org/About.
9. Jagadeeswaran R, Murugappan V, Govindaswamy M. Effect of slow release NPK fertilizer sources on the nutrient use efficiency in turmeric (*curcuma longa L.*). World Journal of Agricultural Science. 2005;1(1):65-69.
10. Jamal Z, Hamayun M, Ahmad N, Chaudhary MF. Effects of Soil and Foliar Application of Different Concentrations of NPK and Foliar Application of (NH4) 2 SO4 on Different Yield Parameters in Wheat. Journal of Agronomy, 2006.
11. Jan T, Jan MT, Arif M, Akbar H, Ali S. Response of wheat to source, type and time of nitrogen application. Sarhad Journal of Agriculture. 2007;23(4):871.
12. More NB, Shinde BN. Effect of NPK fertilizer briquette on sugarcane. Bharatiya Sugar, 2000, 17-27.
13. More NB, Deshmukh SV, Pol KM. Effect of NPK Briquette on yield and quality of sugarcane. J Agric. Res. Tech. 2012;37(3):353-358.
14. Raun WR, Johnson GV. Improving nitrogen use efficiency for cereal production. Agronomy journal. 1999. May;91(3):357-63. [Google Scholar]
15. Savant NK, Sonar KR. Integrated use of Urea-DAP briquettes for crops. Book published by IBDC, Publisher, Lucknow, 2010.
16. Tiwari KN, Kaore SV, Pal V, Maximizing fertilizer use efficiency. Indian farming. 2012;62(4):14-17.