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Effect of multinutrient briquettes (NPKZn) on growth, yield and quality of Bt-cotton grown on vertisol

GC Kakde and VD Patil

Abstract
An experiment was conducted during *kharif* season during the year 2016-17 to study the effect of multinutrient briquettes on growth, yield and quality of Bt-cotton grown in vertisol. There was a significant effect of multinutrients briquettes (NPKZn) on plant height, number of leaves, number of bolls per plant, fresh weight gm per plant, seed cotton yield and stalk yield, test weight, lint index, ginning percentage, fiber length and micronair value. The application of NPKZn briquettes @ 120:60:60:20 kg ha^{-1} coupled with drip irrigation was recorded higher seed cotton yield, which were at par with application of NPK Briquettes with drip irrigation. The results emerged out clearly indicated that various growth parameters like plant height, number of bolls per plant, fresh weight per plant, seed cotton yield and stalk yield was increased due to application of NPKZn briquettes applied through drip irrigation. It was inferred from the results that application of NPKZn briquettes @ 120:60:60:20 kg ha^{-1} coupled with drip irrigation found superior over only NPK Briquettes with drip irrigation and RDF (120:60:60 N and P_2O_5 K_2Okg ha^{-1}).

Keywords: briquettes, growth, yield, quality, Bt-cotton

Introduction
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. A premier cash crop popularly known as `White Gold`, is good source of natural fibre and to some extent a supplementary source of edible oil. It contributes 29.8 per cent of the Indian agricultural gross domestic product (Sreenivasan and Ravindran, 2010) [8]. The essential plant nutrient therefore must supplied in balance form and its proper concentration in soil solution which can show its maximum capacity to produce the economic yield. The nutrient for plant growth needs to be supplied in right time and in right quantities.
Nitrogen being a highly leachable nutrient its application by split application becomes important as it is supplied ideally in a time when crop critically needs it. Bt-cotton differs in its requirement either by total or part of it in the different stages of crop. Phosphorus is another important nutrient in cotton production. It is essential for vigorous root and shoot growth, promotes early boll development, hastens maturity, helps to overcome the effects of compaction, increases water use efficiency, and is necessary for energy storage and transfer in plants. The function of potassium in plant is to increase root growth and improve drought resistance. Zinc functions generally as a metal activator of enzymes. Zinc deficiency is wide spread in Marathwada region, it varies between 62 to 89 % (Patil, 2013).Besides increasing crop yield Zn application increases the crude protein content, amino acids, energy value and total lipid.
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. The basic information on pattern of N, P, K and Zn flux to plant root at the placement of such briquette in not available. 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. Hence present investigation on **"**Effect of multi-nutrient briquettes (NPKZn) on growth, yield and quality of Bt-cotton grown under Vertisol**"** was planned and conducted.

Materials and Methods
The field experiments were conducted during 2015-16 and 2016-17 at experimental farm of Department of Soil Science and Agricultural Chemistry, Vasantrao Naik Marathwada Krishi

Vidyapeeth, Parbhani during *kharif* seasons on Typic *Haplusterts*. The field experiments were laid out in a Randomized Block Design with five treatments T_1: Absolute Control, T_2: 120:60:60 by N, P_2O_5, and K_2O kg ha^{-1} with Drip irrigation, T_3: RDF through fertigation (soluble fertilizer: 80:40:40 NPK kg ha^{-1} in six splits, 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 $ZnSO_4$ kg ha^{-1}) and replicated four times.

Soil of experimental field was well drained, clayey in texture, alkaline in nature, within safe limit of electrical conductivity. The soil was medium in organic carbon content and non calcareous in nature. The soil fertility showed low nitrogen and phosphorus availability and very high availability of potassium. Further, the soil was low in DTPA Zn, Fe and sufficient in DTPA Mn and Cu.Growth and yield contributions characters were recorded at harvest. In each plot, 5 random plants were selected to be record biometric observations on growth and yield attributes. Five plants uprooted from the observation unit for recording the dry matter studies and plant samples were kept in well labelled brown paper bag. First the samples are dried in shade and after that kept in oven at $65^0C \pm 2^0C$, and then weight of dry matter was taken and expressed on per plant basis. All the data were subjected to analysis of variance.

Results and Discussion

Effect of multinutrient briquettes (NPKZn)

Effect on growth

The data presented in Table 1 revealed that application of multinutrient briquettes (NPKZn) caused significant variation on the plant height, number of leaves, number of bolls per plant, boll weight and fresh weight gm per plant. The maximum plant height, number of leaves, number of bolls per plant, boll weight and fresh weight gm per plant were obtained with treatment NPKZN briquettes coupled with drip irrigation (T_5) at boll bursting stage. However, the plant height was significantly highest in treatment NPKZN briquettes coupled with drip irrigation (T_5). Both the treatments are significantly superior over RDF through conventional and control. Bt cotton showed more response to application of RDF through soluble fertilizer (T_3) at boll bursting stage, increase in height of cotton was from 86.39 to 103.23 cm as against 78.63 to 102.65 cm in T_4 treatment. The numbers of leaves were increased from 76.95 to 99.15, boll development stage due to application of NPKZn briquettes, which proved significantly better in increasing the number of leaves $plant^{-1}$ followed by treatment T_4 (NPK briquette) and T_3 (Soluble fertilizer through fertigation). In boll bursting stage treatment T_5 and T_4 were equally effective and on par and depicted superiority over rest of the treatments.

The improvement in growth parameters of Bt-cotton due to briquette application can be attributed to uninterrupted supply of nutrients to cotton through-out the crop growth period of cotton It can be inferred from above interpretation that increase in growth was attributed to slow release of nutrients and additive effect of Zn. Further, spilt application of nutrient through briquette also helped in growth improvement. Similar results were reported by Gill *et al.* (2006), Bhagat *et al*. (2005) [1], Mendhe *et al*. (2006) [4], Singh *et al.* (2006), Patil (1988) and Pillai (2004) [6].

Effect on grain yield

The data revealed that (Table 2) grain yield was lowest (550.50 kg ha^{-1}) in unfertilized plot i.e. absolute control (T_1) while yield was improved in nutrient added plots through briquettes. NPKZn briquettes application showed significant increase in seed cotton yield of Bt-cotton in all the treatments over control (T_1) and RDF through conventional fertilizer (T_2). The application of NPKZn Briquettes and Drip irrigation significantly influenced the seed cotton yield showed yield increase from 11.51 to 16.88 q ha^{-1} with an average of 14.32 q ha^{-1} due to application of various treatments. Among the various treatments treatment T_5 out yielded and produced 16.88 q ha^{-1}. Seed cotton and stood first showing its significance over T_2 and T_1. However, it was at par with T_3 and T_4. The percent increase in yield by treatment T_5 over T_1 was 45%, T_2-31%, T_3-6% and over T_4 16%, respectively. The stalk yield produced by cotton due to various treatment ranged between 57.96 q ha^{-1} in absolute control to 69.80 q ha^{-1} in treatment T_5 with an average of 66.41 q ha^{-1}. Among the various treatments treatment T_3 T_4 and T_5 found statistically on par stalk yield production and significantly superior over absolute control. These results indicate positive effect of deep placement of nutrients/fertilizers on cotton yield. The increase in cotton yield as observed in the present study was due to the spontaneous supply of nitrogen from NPK briquettes throughout the growing period of cotton and due to minimum loss of nitrogen as because of deep placement. These findings are well corroborated with Kapoor *et al.* (2008) [3] and Islam *et al.* (2011) [2] who observed increased cotton yield due to application of NPK briquettes.

Effect on quality parameters

The various treatments administrated showed non significant effect in respect of fi test weight, lint index, ginning percentage, fiber length and micronair value. In general, the results showed that quality parameters improved due to the multinutrient briquettes application of NPKZn nutrients and said treatment T_5 stood first followed by T_4.However the micronair value which shows decrease with the addition of fertilizer either through soil, fertigation or briquette. Maximum reduction in micronair value was recorded in treatment receiving NPKZn through briquettes followed by only NPK briquette and fertigation of soluble fertilizers. However the differences due to administer treatments could not reach to the level of significance.

Thus, from data presented in Table 2, it can be inferred that even though quality character of cotton are mainly influenced by its genetic makeup, in present investigation the quality parameters are improved. This improvement in quality parameter of cotton might be because of balanced nutrition received by cotton through multinutrients briquette and drip irrigation. Many researchers recorded positive effect of nutrient application on quality parameters.

Table 1: Effect of multinutrients briquettes on growth and yield attributes of Bt-cotton

Treatments		Plant height (cm)	Number of leaves	Fresh weight (gm per plant)	Number of bolls	Boll weight (gm)	Seed cotton Yield (q/ha)	Stalk yield (q/ha)
T_1	Absolute Control (Drip irrigation)	86.28	84.98	161.95	47.07	4.36	11.51	57.96
T_2	RDF (Soil)	88.85	115.29	210.93	49.51	5.28	12.81	65.83
T_3	Soluble Fertilizers (fertigation)	103.23	136.37	235.93	52.94	5.64	15.91	69.97
T_4	NPK briquettes with Drip	102.65	133.83	264.83	53.54	5.42	15.49	68.52
T_5	NPKZn briquettes with Drip	107.40	138.95	275.25	53.72	5.65	16.88	69.80
Grand mean		97.68	121.87	229.78	51.36	5.27	14.32	66.41
S.Em (±)		2.15	7.41	5.46	0.92	0.11	0.82	2.91
CD at 5%		6.27	29.08	15.93	2.67	0.44	2.39	11.41

Table 2: Effect of multinutrients briquettes on quality parameters of Bt-cotton

Treatments		Lint index	Test weight	Ginning %	Fiber length (mm)	Micronair Value
T_1	Absolute Control (Drip irrigation)	3.11	5.45	29.80	25.45	2.51
T_2	RDF (Soil)	3.47	5.50	30.28	25.50	2.46
T_3	Soluble Fertilizers (fertigation)	3.49	5.73	30.60	25.62	2.30
T_4	NPK briquettes with Drip	3.59	6.03	31.03	25.70	2.40
T_5	NPKZn briquettes with Drip	3.64	6.28	31.32	25.75	2.20
Grand mean		3.46	5.80	30.61	25.61	2.37
S.Em (±)		0.12	0.17	0.39	0.11	0.03
CD at 5%		NS	NS	NS	NS	NS

Conclusion

The application of NPKZn briquettes @ 120:60:60:20 kg ha^{-1} coupled with drip irrigation was found to be effective in improving the biometric parameters, growth and yield attributes *viz*., height of plant, number of leaves, leaf area, fresh weight, number of bolls, dry matter yield and seed cotton yield. However, The improvement in quality parameters of cotton due to application of multinutrients briquettes (NPKZn) in combination with drip irrigation.

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