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Effect of Land Configuration and Nutrient Management on Productivity of Bt Cotton

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Abstract: *The field experiment was conducted during* kharif *season of year 2011-2012 at Farm of AICRP on IFS, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. The experiment was laid out in split plot design with three replication in order to study the effect of land configuration and nutrient management treatments and their integration effect on growth, yield attributes and productivity of cotton.The mean plot treatments comprised of three land configuration treatments viz., flat bed sowing, opening of furrow after each row and opening of furrow after two rows while the sub plot treatments consisted of nutrient management* viz. *100% RDF (120:60:60 NPK kg /ha), 25% RDF + 10 t FYM + PSB + Azotobacter, 25% RDF + 10 t FYM + two row of bio-mulches of sannhemp, 50% RDF + 5 t FYM + PSB + Azatobacter. Opening of furrow after each row increase the growth, yield (1897 Kg/ha) and yield attributes as compared to flat bed sowing and opening of furrow after two rows. Application of 100% RDF increased growth, yield (2007 Kg/ha) and yield attributes followed by 50% RDF + 5 t FYM + PSB + Azatobacter.*

Keyword*: cotton, furrow , growth, yield, etc.*

INTRODUCTION

In India cotton crop occupies an area about 121.91 lakh hectares with production of 355 lakh bales and productivity 503 kg lint/ha, while in Maharashtra state the area under this crop is 41.95 lakh hectares with production of 85 lakh bales and productivity 341 kg lint/ ha (CAB-2011).India rank first in world and Maharashtra state ranks first in country as to acerage under cotton crop concerned. However the productivity of cotton in our country is 503 kg lint/ ha and Maharashtra state is 341 kg lint/ha which is low as compared to national average.

In rainfed area the attempts has been made to conserve as much as rainwater as possible where is fall through land and soil treatments for better *in-situ* moisture conservation. Land configuration plays an important role in conservation of maximum possible rainwater in the soil. Land configuration is mechanical measure for better *in-situ* moisture conservation as the soil profile acts as reservoir for moisture storage and the facility need to exploit to the maximum extent. This can be achieved by cultural and mechanical method of tillage operations, contour cultivation, vertical mulch, ridges and furrows, broad bed furrows, opening of furrow and farm ponds. (Pendke *et al*. 2000).

Besides various factor responsible for low productivity, major one as nutrient management influencing nutrient availability. Integrated nutrient management system is an approach through which the management of plant nutrition and soil fertility in farming system is adopted to take organic sources and recycling do not suffice the increase demand for agricultural production on fixed land area, on the other hand chemical fertilizers causes environmental hazards and have economic constraint. Therefore, optional exploitation and combination of sources, organic and inorganic material will be beneficial to increase crop yield, soil health and maintaining the long term productivity. The mixed applications are not only complementary but synergistic since organic inputs have beneficial effect beyond their nutritional contents.In sustainable crop production, organic manuring plays an important role in enhancing the productivity. The organic material included compost, FYM, vermicompost, green manuring and crop residues etc. FYM is worldwide accepted as soil fertility booster, soil conditioner and best organic manure with all required plant nutrients enzymes, growth hormones and humus, organic carbon, vitamin and beneficial microbes.

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Major cause for low productivity of cotton is soil moisture stresses, delayed sowing and erratic rainfall. Besides this, there are other reasons for poor cotton yield. Drought conditions during flowering and boll development stage (August-September) adversely affects the growth and later the shedding of reproductive parts resulting in crop yield. There is ample scope to boost the yield by adopting soil management practices for soil moisture conservation and good drainage, intercultural operations, nutrient management practices and plant protection measures etc. Among various major limiting factor for low yields, water plays an important role. Major source of water for crops is the rainfall received from South-West monsoon during period from June-September. This rainfall is erratic in nature, unevenly distributed and sometimes it is inadequate to meet soil moisture requirement for crop production.

MATERIAL AND METHOD

The experiment was conducted at the farm of All India Co-ordinated Research project on Integrated farming systems, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *kharif* season of 2011-12.The soil of experimental field was clay loam in texture, having slightly alkaline in nature (pH 8.01), moderate organic carbon content, low in available nitrogen, low in available phosphorous and rich in available potassium. The experiment was laid out in split plot design with twelve treatment combinations and three replication. Main plot treatments consisted of three land configuration *viz.,* flat bed sowing, opening of furrow after each row and opening of furrow after two rows while the sub plot treatments consisted of nutrient management viz. 100% RDF (120:60:60 NPK kg /ha), 25% RDF + 10 t FYM + PSB + Azotobacter, 25% RDF + 10 t FYM + two row of bio-mulches of sannhemp, 50% RDF + 5 t FYM + PSB + Azatobacter. Seed of cotton variety NCS-145 (Bunny Bt) was sown by dibbling method.The sowing of seed was done at 120 cm distance between rows. The plant to plant distance was maintained at 45cm.

Land configuration treatment at 30 DAS furrows were opened between two rows with the help of harrow by tying the rope on the tyne in treatment. Opening of furrow after each rows and opening of furrows in alternate row in treatment. Farm yard manure @ 5 t/ha, 10t/ha was applied treatments wise in the field and thoroughly mixed in the soil about 15 days before sowing. The sannhemp was uprooted and put on surface of soil at 30 DAS. The crop was fertilized with different levels of nitrogen, phosphors and potassium as per the treatments. Application of phosphorus solubulizing bacteria and Azotobacter as seed treatments was done at the time of sowing. Nitrogen as per treatments was applied in two equal splits i.e. half dose at the time of sowing and remaining half dose at 30 DAS (square formation stage). Full dose of phosphorous and potash was given to all plots at the time of sowing as per treatments.

Five plants were randomly selected from each net plot in per treatment in all replications and labelled for recording the various biometric observations. The statistical analysis was done as per the statistical procedure for split plot design as given by Gomez and Gomez (1988). The statistical analysis of plant character was analyzed by variance method (Panse and Sukhatme, 1967).

RESULT AND DISCUSSION

Effect of land configuration on growth attributes

All the growth attributes like plant height, number of monopodial and sympodial branches, number of functional leaves and dry matter accumulation/plant were significantly influenced by land configuration treatments. The rate of increase in height was fast upto 90 DAS and slowed down towards maturity, land configuration treatment of opening of furrow after each row (L_2). proved significantly superior over opening of furrow after two rows (L_3) and flat bed (L_1). Similarly early vigour in plant height was recorded by Gaidhane *et al.* (2007).

The number of functional leaves, and dry matter accumulation/plant were influenced due to land configuration treatment From early growth stages, opening of furrow after each row (L_2) exhibited early seedling vigour in term of more number of functional leaves, and dry matter accumulation/plant as compared to other land configuration treatment. This might to be due to increased in height resulted in increase in number of branches with increase in number of leaves, leaf area/plant and dry matter accumulation/plant with maximum photosynthates accumulation towards sinks. Similar result also reported by Gaidhane *et al*. (2007) Pore and Bhake (1992) indicating that land configuration significantly influenced growth components. From the result it was observed that there was more plant growth resulted in optimum cell division and cell growth which ultimately enhanced plant height in opening of furrow after each row (L_2), proved significantly superior over rest treatment. Similarly, early vigour in plant height was recorded by Patil and More. (1992).

The results indicated that there were significant variation in number of monopodial and sympodial branches produced due to different land configuration treatments . Research of present investigation are similar with findings of Thakare *et al*. (1989).

Effect of land configuration on yield attributes and yield

Number of bolls/plant were significantly higher in opening of furrow after each row (L_2) compared to opening of furrow after two rows (L_3) and flat bed sowing (L_1). The variation in number of bolls in all the land configuration treatments was differential amount of more moisture conserved in opening of furrow after each row (L_2) compared to flat bed sowing (L_1) and opening of furrow after two rows (L_3).

Number of picked bolls/plant were significantly more in opening of furrow after each row (L_2) compared to other land configuration treatments The variation in number of picked bolls/plant in Bt cotton hybrid under study was basically, due to nutrient management and available soil moisture. The significant variability number of picked bolls/plant in cotton hybrid and land configuration have been established by Mankar *et al*. (2008).

It was observed from the result that the average boll weight (g) and seed cotton yield/plant (g) was influenced significantly due to land configuration treatments. Land configuration treatment opening of furrow after each row (L_2) produced significantly heavy boll weight (3.15 g) and more seed cotton yield/ plant (117.60 g) as compared to other land configuration treatments. This indicated that more retention of soil moisture has resulted in higher number of bolls in Bt cotton hybrid and it might have got the full advantage of available soil moisture and nutrient management during boll development stage which in turn reflected in higher boll weight and seed cotton yield/plant. Adequate soil moisture conservation through opening of furrow after each row resulted into higher boll weight and more seed cotton yield/plant especially in rainfed cotton zone as reported by Kubsad *et al*. (2004).

Opening of furrow after each row (L_2) recorded significantly higher seed cotton yield (kg/ha) over other land configuration treatments. The opening of furrow after each row (L_2) produced the higher seed cotton yield 1897 kg/ha. The increase in seed cotton yield (kg/ha) in opening of furrow after each row (L_2) might to attributed better fruiting efficiency, efficient source sink relationship, balanced vegetative growth, more number of picked bolls/plant and finally seed cotton yield (kg/ha). The higher yield advantage in opening of furrow after each row was also recorded with worker Hulihalli and Patil. (2005).

The stalk yield and biological yield (kg/ha) were significantly influenced due to land configuration treatment where in opening of furrow after each row (L_2) produced highest stalk yield and biological yield (2485 kg/ha) and (4369 kg/ha) respectively. The more amount of soil moisture conserved due to opening of furrow after each row (L_2) result in increased growth attributes finally might have exhibited significant improvement in stalk yield and biological yield. Similar result were reported by Gaidhane *et al*. (2007) and Asewar and Jadhav (2008).

Regarding the harvest index was not influenced by land configuration treatments. This was indicative of fact that these parameter were primarily governed by the genetic make up of cotton hybrids. These observation were in conformity with Patil *et al*. (1994).

Effect of Nutrient management o growth attributes

Application of RDF (N_1) produced the taller stages of growth. It was significantly higher over 25%RDF+10t FYM+PSB+Azotobacter (N_2) and 25%RDF+10t FYM+two rows of bio-mulch of sannhemp (N_3). Treatment 50%RDF+5t FYM+PSB+Azotobacter (N_4) at par with (N_1) 100%RDF at all the growth stages. Due to greater availability of nutrient i.e RDF (N_1) in turn facilitated translocation tissues. It is well documents fact that application of phosphorus assist in absorption of metabolites, water and its further translocation for the growth of plant in term of height. Application of K_2O help in activation of enzymes in meristematic tissue and it plays decisive role in cell wall plasticity resulting in increased growth. Earlier Shenoy *et al*. (1999) reported increased plant height with the application of nutrient.

Application of RDF (N_1) resulted in significantly higher number of monopodial branches plant at 60 to 120 DAS. The application of RDF (N_1)at par with 50%RDF+5t FYM+PSB+Azotobacter (N_4) treatments and superior over (N_3). It was equally effective in enhancing the number of sympodial branches/plant. The observation are in conformity with Singh *et al*. (2004), Badole and More (2000) and Anonymous (2006).

The application of 100% RDF (N_1) was found effective in enhancing the number of functional leaves and leaf area/plant (dm^2). Whereas, it was recorded significantly higher number of functional leaves and leaf area/plant compared to all other treatments at all growth stages, except it was at par with 50%RDF+5t FYM+PSB+Azotobacter (N_4) during stage of crop growth. Substaintial improvement in number of functional leaves and leaf area/plant (dm^2) due to application of higher levels of nutrient in cotton were reported earlier by Shenoy *et al*. (1999), Gaidhane *et al*. (2007).

Application of RDF (N_1) recorded highest dry matter/plant and it was at par with 50%RDF+5t FYM+PSB+Azotobacter (N_4). Treatment 25%RDF+10t FYM+two rows of bio-mulch of sannhemp (N3) and 50%RDF+5t FYM+PSB+Azotobacter (N4) were at par with each other at all growth stages. The observation under this study were confirmed by the findings of Katkar *et al*. (2002) and Badole and More (2000), resulted that every higher level of fertilizer application resulted in higher dry matter accumulation/plant.

Effect of Nutrient management on yield attributes and yield

Yield contributing characters viz., number of bolls/ plant and number of picked bolls/plant improved significantly due to nutrient management Application of RDF (N_1) found effective in enhancing the number of bolls/plant and number of picked bolls/plant and established it significant superiority over rest of all other treatments except 50% RDF+5t FYM+PSB+Azotobacter at par with N_1. The cumulative effect of fertilizer application finally improved yield attributes i.e. number of bolls/plant and number of picked bolls/plant. Similar advantage of nutrient management in improving the number of bolls/plant and number of picked bolls/plant of cotton were reported earlier by Katkar *et al*. (2002), Mankar *et al*, (2008) and Kaur *et al* (2007).

Application of RDF (N_1) was found effective in enhancing the seed cotton yield/plant (g) and established its significant superiority over rest of treatment except 50%RDF+5t FYM+PSB+Azotobacter (N_4) which is at par with Application of RDF (N_1). The substaintial increase in seed cotton yield/plant due to application of RDF (N_1) over rest of treatments associated with improvement in various growth attributes and its subsequent translocation towards sinks. The result confirmity with Bastia (2000), Wankhade *et al*. (2001), Katkar *et al* (2002) and Kaur *et al*. (2007).

Application of RDF (N_1) was resulted in significantly higher seed cotton yield over rest of treatment except 50%RDF+5t FYM+PSB+Azotobacter (N_4) which is at par to N_1. The cumulative effect of fertilizer application finally might have reflected in yield attributes result of this findings have been reported by Giri *et al*. (1992), Bastia (2000), Lokhande *et al*. (2004) and Giri *et al*. (2006).The increase in seed cotton yield with application of RDF was obtained which might be owing to better uptake of different nutrients leading to greater dry matter production and its translocation to the sink. Dev Raj *et al*. (2007) also reported similar results.

It was observed that stalk yield significantly increased due to the application of RDF (N_1) recorded maximum stalk yield and it was higher than all other treatment except 50%RDF+5t FYM+PSB+Azotobacter (N_4) which was at par to N_1. It was observed the fact that due to more availability of nutrients as per needs of crop growth. The biological yield was significantly

Table 1
Growth attributes as influenced by land configuration and nutrient management treatments of cotton

Treatment	*Plant height (cm)*	*No. of leaves plant^{-1}*	*No. of Monopodial Branches*	*No. of Sympodial Branches*	*Total dry matter (g)*
Land configuration					
L_1	118.92	150.87	2.14	22.28	121.35
L_2	144.41	170.98	2.65	26.41	154.33
L_3	131.79	160.88	2.41	23.39	144.45
SE(m)±	3.33	3.16	0.03	0.60	2.36
CD at 5%	9.88	9.37	0.09	1.80	7.83
Nutrient management					
N_1	140.80	178.70	2.70	26.36	153.72
N_2	122.54	143.16	2.10	22.34	133.11
N_3	130.54	160.70	2.37	23.31	143.78
N_4	132.93	161.09	2.51	25.43	144.90
SE(m)±	2.38	2.60	0.07	0.63	3.01
CD at 5%	7.14	7.74	0.21	1.90	9.04
Interaction(LxM)					
SE(m)±	5.04	4.52	0.13	1.09	1.23
CD at 5%	NS	NS	NS	NS	NS

Table 2
Yield attributes and yield as influenced by land configuration and nutrient management treatments

Treatment	No. of bolls/ plant	Picked bolls/ plant	Boll weight (g)	Seed cotton yield/plant (g)	Seed cotton yield (kg/ ha)	Stalk yield (kg/ha)	Biological yield (kg/ ha)	Harvest index
Land configuration								
L_1	35.08	33.83	2.75	93.25	1451	2011	3463	41.90
L_2	37.95	37.06	3.15	117.60	1897	2485	4369	42.85
L_3	36.15	34.75	2.84	99.68	1571	2170	3709	42.12
SE(m)±	0.09	0.11	0.012	0.36	59	32	34	0.12
CD at 5%	0.28	0.34	0.037	1.05	178	98	101	NS
Nutrient management								
N_1	40.25	39.43	3.17	115.18	2007	2489	4496	44.62
N_2	32.40	31.07	2.64	82.74	1273	1895	3169	40.43
N_3	34.60	33.47	3.10	93.53	1457	2075	3532	41.17
N_4	39.32	38.88	2.90	114.25	1892	2383	4331	41.35
SE(m)±	0.15	0.08	0.013	0.40	65	33	32	0.17
CD at 5%	0.45	0.25	0.040	1.21	197	101	127	NS
Interaction(LXM)								
SE(m)±	0.27	0.14	0.023	0.71	104	58	56	0.28
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS
GM	36.39	35.21	2.91	103.68	1632	2224	3844	42.27

improved due to application of RDF (N_1) than all other nutrient treatments. The maximum amount of nutrients available due to the highest amount of fertilizers was applied.

REFERENCES

Anonymous, (2006), Central Institute of Cotton Research Nagpur, Annual Report-2006.

Asewar, B.V., A.S. Jadhav and Y.A. Khan, (2008), Effect of in situ water management and intercropping systems on yield of rainfed cotton. *J. Cotton Res. Dev*. 22(2): 173-175.

Badole, S.B. and S.D. More, (2000), Yield and nutrients uptake as influenced by integrated nutrient supply system in cotton. *J. Indian Soc. Improv*. 25(3):161-163.

Dev Raj, A.P. Sharma, B.S. Duhan and Promila Kumari, (2007), Effect of organic and inorganic source of nutrients on cotton productivity and nutrient use efficiency under irrigated condition. *J. Cotton Res. Dev*. 22(1): 69-73.

Gaidhane, S.N., P.B. Mankar, V.S. Khawale, M.D. Yepediwar, (2007), Effect of land configuration & mulches on growth & yield of arborium cotton. *J. Soils & crops*. 17(2): 403-406.

Hulihalli V.K. & V.C. Patil (2005), Effect of in- situ moisture conservation practices & organic manure on yield & quality of (G. *hirsutum* L.) grown on vertisols *PKV- Res J*. 30(2): 135-143.

Katkar, R.N., A.B. Turkhade, S.T. Wankhade & Y.M. Solanke (2002), Response of cotton integrated management of various types of organic manures & fertilizers. *Crop Res*. 21(5): 194-195.

Kaur Manindar, Mandeep Kaur & A.B. Brar, (2007), Effect of nutrients applied through organic & inorganic sources on the growth & yield of American cotton (*Gossipium hirsutum* L) *J. cotton Res. Dev*. 121(2): 194-196.

Mankar, P.S., W.S Pawar, S.N Mendhe, R.M. Deshpande and A.N. Chimote, (2008), Effect of land configuration and addition of weed Biomass on Moisture content, fertility status and yield of cotton. *PKV Res. J*. 32(1): 15-19.

Patil S.N., D.K. Morey, S.R. Deshmukh (1992), Performance of land configuration for better in-situ moisture conservation & crop yield of cotton .*PKV. Res. J*. 16(1): 19-22.

Patil S.N., M.S. Khakare & R.S. Raut (1994), Effect of in-situ moisture conservation measures on yield, water conservation ET & WUE of grain sorghum under rainfed conditions. *PKV. Res.J* 16(2): 170-172.

Mankar, P.S., W.S Pawar, S.N Mendhe, R.M. Deshpande and A.N.Chimote, (2008), Effect of land configuration and addition of weed Biomass on Moisture content, fertility status and yield of cotton. *PKV Res. J*. 32(1): 15-19.

Shenoy H., V.S. Gidnavar, R. Balraj, S.N. Bhat. (1999), Effect of rain water harvesting, plant population & fertilizer levels on growth & yields of rainfed cotton (*Gossipium hirsutum*) *Advanced in Agric. Res. India* 12:71-75.

Thakare, V.S. , H.N. Ravankar & R.M. Deshpande (1989), Role of ridges & furrows an contour in the management of rain water & soil moisture in cotton production. *Cotton Dev*. 18(3&4): 33-36.

Wankhede, S.T., A.B. Turkhade, R.N. Katkar, V.M. solanke & B. A. Sakhare. (2001), Effect of bio-mulching & fertilizer on growth & yield of cotton. *Crop res*. 21(1): 34-37.