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Impact of Soil Moisture Conservation Practices and Nutrient Management Under High Density Planting System of Cotton

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ABSTRACT
A field experiment was conducted at Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth , Akola during the year 2014-15 with a view to study the moisture conservation techniques and nutrient requirement for cotton variety AKH-081 which is suitable genotype recommended for High Density Planting System for Vidharbha condition of Maharashtra. The experiment was laid out in split plot design replicated thrice with twelve treatments. The plot size was 6.0 x 4.5 meters spacing at 60 x 10 cm with 1.66 lakh plants per hectare. Three moisture conservation techniques consisting flat sowing, opening of furrow at 40-60 days after sowing and sowing on Broad Bed Furrow (BBF) 3 rows marked at 60 cm along with nutrient management levels RDF (60:30:30 NPK kg ha^{-1}) ,RDF + 2.5 kg Zn ha^{-1}, 125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) and 125 % RDF +2.5 kg Zn ha^{-1}. The growth parameters viz. Plant height and sympodia was significantly influenced due to different moisture conservation techniques. BBF exihibited highest Plant height, Sympodia and Dry matter over the other parameter. The plant height, sympodia and dry matter per plant was increased significantly with increased in nutrient levels with micronutrients for high density planting system of cotton. Nutrients with different levels significantly influenced the yield attributes i.e Boll weight and Seed cotton yield under high density planting system. Significantly highest Seed cotton yield of (1786 kg ha^{-1}) and was recorded with 125 % RDF + 2.5 kg Zn ha^{-1} which was at par with 125 % RDF. The highest gross monetary return, net monetary returns and benefit cost ratio was recorded with 125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) + 2.5 Kg Zn ha^{-1} which was at par with125 % RDF (75:37.5:37.5 NPK kg ha-1) which is the need of higher plant density. The highest WUE (3.02 kghamm^{-1}) was noticed in 125 % RDF + Zn.

***Key words** : BBF, HDPS, moisture conservation practices, nutrient management and SCY*

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I. INTRODUCTION

Cotton the "white gold" is one of the most important fibre crop of India. It play prominent role in the National and International economy. It is grown mainly for its fibre, used in the manufacture of cloth for mankind. In spite of severe competition from synthetic fibre, cotton continues to enjoy a place of prime important of textile industries. A cotton variety AKH-081 is dwarf, tolerant to sucking pest and early maturing (140-160 days). The variety was released in the year 1987 by Dr. PDKV. Akola and recommended for HDP (1.11 lakh ha^{-1}) cultivation in Vidarbha region. It has high yield potential under rainfed condition and escaping bollworm damage due to early maturity with minimum spraying shedule. It is suitable for shallow to medium deep soil. There is need to increase the production of cotton for strengthen national economy. Due to increase in population and limited land availability, it has become necessary to increase productivity of marginal farmers with low input and it can be achieved through high density planting system under rainfed. So trend towards high density panting is moving fast. There is a positive relationship between plant population and seed cotton yield. Optimum plant population is one of the factor for increasing the yield per unit area (Shrama et al 2001). The significance of *in-situ* soil moisture conservation measure is to conserve maximum possible rainwater at a place where it falls, to make efficient use of it. Soil management and organic practices are tailored to store and conserve as much rainfall as possible by reducing runoff and increasing storage capacity of soil profile. Land configuration and adding mulches in furrow opened together may elongate period of moisture availability to crop, release of mineral nutrient which plant may absorb and also may drain excess water and also increase infiltration and moisture conservation *in-situ*.The practices of opening furrow in between row of crop is also beneficial for improving the drainage system in field during early monsoon and for decomposing added weed later on. Ridge may serve as micro-watershed accumulating water in furrow. Practices of making ridge by opening furrow may have an advantage in concentration of more rain water on the bed which enrich soil

moisture content (Gidda and Morey,1981). With this view the study was conducted to find out optimum nutrient management and moisture conservation practices for HDPS cotton.

II. MATERIAL AND METHODS

A field experiment was conducted at Cotton Research Unit, Dr. PDKV Akola (M.S) 2014 during kharif season. The experiment was laid out in split plot design replicated thrice with twelve treatments. The plot size was 6.0 x 4.5 meters spacing at 60 x 10 cm with 1.66 lakh plants per hectare. Three moisture conservation techniques consisting flat sowing, opening of furrow at 40-60 days after sowing and sowing on Broad Bed Furrow (BBF) 3 rows marked at 60 cm along with nutrient management levels RDF (60:30:30 NPK kg ha^{-1}) ,RDF + 2.5 kg Zn ha^{-1}, 125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) and 125 % RDF +2.5 kg Zn ha^{-1}. The soil of experimental field was medium deep black low in available nitrogen (180 kg ha^{-1}), low in available phosphorus (14.3 kg ha^{-1}) and rich in available potassium (401 kg ha^{-1}), 4.2 % organic carbon. The nutrients were applied as per treatments. Fifty percent nitrogen and full dose of phosphours, potassium and Zn sulphate fertilizers were applied at the time of sowing. Remaining fifty percent nitrogen was applied after 30 DAE. Plant protection measures were taken against bollworm complex. The growth, reproductive parameters and SCY were recorded. The monetary returns were recorded as per prevailing market prices. The rainfall of the season was 592 mm in 32 rainy days against normal rainfall of 763 mm in 41 rainy days. The rainfall is less by 22.3 %.

III. RESULTS AND DISCUSSION

Effect of Moisture Conservation Techniques

The growth parameters viz. Plant height, Sympodia and Dry matter was significantly influenced due to different moisture conservation techniques (Table 1). BBF exihibited highest Plant height, Sympodia and Dry matter over the other parameter. Whereas seed index was also highest with BBF might be due to moisture conservation. The yield attributes and seed cotton yield per hectare was significantly influenced due to moisture conservation techniques(Table 2). Numerically the significantly highest Gross monetary return, net monetary returns and benefit cost ratio was obtained under BBF under HDPS. The highest WUE (3.11 kghamm-1) was obtained under Broad Bed Furrow (BBF).

Effect of Nutrient Management

The plant height, sympodia and dry matter per plant was increased significantly with increased in nutrient levels with micronutrients. Similar results were recorded by Bhalerao et al. (2012). Nutrients with different levels significantly influenced the yield attributes i.e Boll weight and Seed cotton yield under high density planting system. Significantly highest Seed cotton yield of (1786 kg ha^{-1}) and was recorded with 125 % RDF + 2.5 kg Zn ha^{-1} which was at par with 125 % RDF. It indicates higher dose of fertilizer with Zn is needed to obtained more SCY under HDPS. The highest gross monetary return, net monetary returns and benefit cost ratio was recorded with 125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) + 2.5 Kg Zn ha^{-1} which was at par with125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) which is the need of higher plant density. The highest WUE (3.02 $kghamm^{-1}$) was noticed in 125 % RDF + Zn.

IV. CONCLUSION

It is concluded that application of 125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) + 2.5 Kg Zn ha^{-1} with moisture conservation practice (BBF) are needed for HDPS cotton under rainfed condition.

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Table 1 : Growth and yield attributes as influenced by moisture conservation techniques and nutrient management under HDPS in cotton.

Treatments	Actual PP lakh ha^{-1} at harvest	Height (cm)	Sympodia $plant^{-1}$	DMW $plant^{-1}$ (g)	100 Seed wt. (g)
I) Main plot treatments A) Moisture Conservation Techniques					
Flat Sowing (Control)	1.44	50.75	5.38	30.42	5.91
Furrow opening at 40-60 DAS	1.43	53.00	6.13	35.22	6.20
Broad Bed Furrow (BBF)	1.44	55.25	7.60	40.02	6.41
S.E. m ±	0.003	0.41	0.36	1.5	0.36
CD at 5%	NS	1.63	1.45	4.6	NS
II) Sub plot treatments B) Nutrient management					
F_1 - RDF (60:30:30 NPK kg ha^{-1})	1.44	49.50	5.283	29.14	5.00
F_2 - RDF + 2.5 Kg Zn ha^{-1})	1.43	52.00	5.783	32.56	5.61
F_3 - 125 % RDF (75:37.5:37.5 NPK kg ha^{-1})	1.45	54.83	6.994	34.11	6.88
F_4-125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) + 2.5 Kg Zn ha^{-1})	1.44	55.66	7.439	36.09	7.22
S.E. m ±	0.01	0.75	0.5634	1.4	0.51
CD at 5%	NS	2.25	1.674	4.3	1.52

Table 2 Seed cotton yield, yield attribute and economics as influenced by moisture conservation techniques and nutrient management under HDPS in cotton.

Treatments	SCY (kg ha^{-1})	Bolls $plant^{-1}$	Boll wt. (g)	GMR (Rs ha^{-1})	COC (Rs ha^{-1})	NMR (Rs ha^{-1})	B:C Ratio	WUE Kg $hamm^{-1}$
I) Main plot treatments A) Moisture Conservation Techniques								
Flat Sowing (Control)	1484	4.12	2.12	60102	31971	28131	1.88	2.51
Furrow opening at 40-60 DAS	1602	4.22	2.16	64881	33563	31318	1.93	2.71
Broad Bed Furrow (BBF))	1842	4.34	2.21	74601	35261	39340	2.12	3.11
S.E. m ±	40	0.3	0.01	1602	-	-	-	-
CD at 5%	157	0.9	0.03	8291	-	-	-	-
II) Sub plot treatments B) Nutrient management								
F_1 - RDF (60:30:30 NPK kg ha^{-1})	1447	3.77	2.12	58603	31752	26851	1.85	2.44
F_2 - RDF + 2.5 Kg Zn ha^{-1})	1633	3.90	2.14	66136	33578	32558	1.97	2.76
F_3 - 125 % RDF (75:37.5:37.5 NPK kg ha^{-1})	1706	4.12	2.24	69093	33885	35208	2.04	2.88
F_4-125 % RDF (75:37.5:37.5 NPK kg ha^{-1}) + 2.5 Kg Zn ha^{-1})	1786	4.20	2.62	72333	35186	37147	2.06	3.02
S.E. m ±	49	0.4	0.03	1985	-	-	-	-
CD at 5%	85	0.13	0.10	5900	-	-	-	-