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Effect of spacing and nutrients management on growth, yield, yield attributes, quality characters and economics in *Hirsutum* cotton in central plain zone of U.P.

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Abstract
Cotton is one of the most commercial crops of the world and in the maintaining of many economics. Cotton is cultivated in nearly 100 countries with China, India, united States, Pakistan and Brazil being the five largest producers of cotton. Cotton is the back born of textile industry and provides raw material in the form of lint to the textile industry. A field experiment was conducted, with *Hirsutum* cotton genotype H-1300 during *kharif* season 2015 at the Oil Seed Farm of C.S. Azad university of Agriculture and technology, Kanpur. It geographically falls in the zone of sub-tropical climate. It is roughly situated between the latitudes 26.20^0 to 28.36^0north and longitude 80^0 to 90^0 East to study the effect of spacing and nutrient management system on growth, yield attributes, yield, quality and economics of *Hirsutum* cotton. The treatment combinations comprising with T_1 - Control without fertilizer + normal spacing (67.5*30 cm), T_2 – 100% RDF + normal Spacing, T_3 – 100% RDF + 25% less than normal spacing, T_4 – 125% RDF + 25% less than normal spacing, T_5 – 125% RDF + 25% less than normal spacing + soil application of $ZnSO_4$, T_6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP, T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ and $ZnSO_4$. The treatments were evaluated in Randomized Block Design with three replications. The normal spacing was kept row to row distance of 67.5 cm and plant to plant distance of 30 cm. crop was fertilized as per respective treatments where half of nitrogen and full dose of phosphorus and potassium was applied at the time of sowing and remaining half of nitrogen was applied in two equal installment one at 30 days after sowing and second at 60 days after sowing. Harvesting was done on the basis of picking when boll was fully open. Application of 125% RDF + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP produced significantly highest growth characters *viz.*, plant height at 30, 60, 90 and 150 days after sowing, number of monopopdia and sympodia, fresh and dry weight/plant, yield attributes viz., number of bolls/m^2, number of bolls/plant and boll weight, yield *viz.*,seed cotton, lint, seed and stick, quality characters *viz.*, ginning out tern, span length, micronaire value, uniformity ratio andfibre strength and economics, it was closely followed by 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$and $ZnSO_4$. On the basis of above results, it may be concluded that *Hirsutum* cotton genotype H-1300 along with application of 125% recommended dose of fertilizers (60:30:20 kg NPK/ha) + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP was most productive and remunerative for cotton under Central Plain Zone of U.P.

Keywords: Triclosan, TCS, determination, detection, sensor

Introduction
Cotton is one of the most commercial crops of the world and in the maintaining of many economics. Cotton is cultivated in nearly 100 countries with China, India, united States, Pakistan and Brazil being the five largest producers of cotton. Cotton is the back born of textile industry and provides raw material in the form of lint to the textile industry. It is also grown in tropical and subtropical regions of more than 80 countries the world over. All the domesticated species of cotton suitable for commercial cultivation have been classified into two categories, new world cotton and old world cotton. The new world cotton has further been divided in to two groups based on fibreproperties. The two old world diploid the species *G. arboreum* is most widely grown and cultivated commercially in India, Pakistan and other parts of South East Asia, primarily on dry and unproductive regions of Bangladesh, Berma, China, Sri Lanka, Viclnam *et al.* (Singh and Narayanan, 1991).

The samples of fabric found in the excavation at Mohenjendaro suggest the manufacture of cotton textile in india was since 5000 years ago. Cotton is the most important crop in india and plays a dominant role in the industrial and economy of the country. The demand of textile market depends upon the quality of cotton fibre and governs by compound functions of mean fibre length, fibre fineness, fibre maturity, fibre strength, combined with the physical components such as colour and to ash contents. Each of these parameters is very important in deciding the spin ability of yarn, acceptance of dyes strength of yarn, luster of fabrics and blending of yarn with other manmade fibres. The fineness, maturity, fibre strength are known to be affected by factors such as drought, nutrients, season, stage of harvest, pests and diseases (Naryadayya, 1960). American cotton recorded, on an average, significantly higher value for seed index and kernel per cent than that of desi cotton. The low productivity of cotton is on account of several reasons, which, monocropping, decline in soil fertility status, late sowings, pests and diseases are the major constraints. Soil properties and crop production are liable to change due to continuous cropping with long term fertilization (Mathur, 1997) [13] and such studies recorded soil fertility depletion trends. Application of organic manures alone or with inorganic fertilizer helps to improve soil productivity and maintain soil fertility. Bt. Cotton hybrids and their scope for extensive coverage in the country in coming years. There is need for change in the nutrient management of Bt cotton hybrids (Venugopal, 2004) [24]. Bt cotton technology has been widely accepted by Indians across the country. Since it is first commercialization in 2002. Productivity of cotton can considerably be improved by approximate fertilizer management. Fulfillment of nutritional requirements of the crop is essential for achieving the higher yields and fibre quality (Kalaichelvi, 2009 and Kumar *et al.*, 2011) [12]. Response of cotton to applied nutrients is governed by environment and cultural factors. Among the various agriculture input, fertilizer have been found to better responsive to the cotton production. So, adequate fertilizer is essential to achieve the potential yield of cotton. However optimum fertilizer dose varies with soil and agro climate condition. It is obvious that the production and productivity of cotton can be improved by introduction of higher yielding genotypes coupled with suitable agronomic practices like maintenance of optimum/ideal plant density. Use of optimum dose of fertilizers and timely control of insect pest as well as proper weed and water management Practices. Application of micronutrients through foliar application has shown importance for their efficient utilization of better performance of crop (Rathinavel *et al*., (1999) [17]. It also regulate the biochemical changes in seed and increase yield of cotton (Chaudhary *et al*., (2001) [4]. Squaring, blooming and boll development are stages where cotton makes highest nutrients demand. Augmentation of nutrient supply through foliar application at such critical stages may increase yield of cotton (Bhatt and Nathu (1986) [2]. The increase in gross and net monetary returns and benefit: cost ratio of cotton might be due to increase in seed cotton yield with the application of higher recommended dose of fertilizers and closer spacing. Jadhav *et al.* (2012) [7] recorded maximum net return with the application of 200:100:100 kg NPK/ha followed by 150:75:75 kg NPK/ha. The increase in economics such as gross and net monetary returns and benefit: cost ratio of cotton with the application of higher doses of fertilizers has also been reported by several workers (Solanki *et al.* 2012 [26]. Therefore the objective of this experiment was to standardize the spacing and nutrient management for growth parameters, yield &yield attributes, quality characters and economics(i. e. number of plants/plot, plant height, Monopodia, Sympodia and number of plants/ha at harvest, fresh weight, dry weight, No. of Balls/ plant, No. of bolls/ m^2 and ball weight, Ginning out turn, Micronaire value, Uniformity ratio, Fibre strength, Seed cotton yield, Lint yield, Cotton seed yield and Stick yield)respectively.

Materials and Methods

A field experiment was conducted, with *Hirsutum* cotton genotype H-1300 during *kharif* season 2015 at the Oil Seed Farm of C.S. Azad university of Agriculture and technology, Kanpur, It is roughly situated between the latitudes 26.20^0 to 28.36^0north and longitude 80^0 to 90^0 East in the zone of sub-tropical climate. The total annual rainfall of the year was 650.6 mm comprising generally from the middle of June and ending the second week of September. Occasional showers were also received from the South-West mansoon during winter. To study the effect of spacing and nutrient management system on growth, yield attributes, yield, and quality of *Hirsutum* cotton. The seven treatment combinations comprising with T_1 - Control without fertilizer + normal spacing (67.5*30 cm), T_2 – 100% RDF + normal Spacing, T_3 – 100% RDF + 25% less than normal spacing, T_4 – 125% RDF + 25% less than normal spacing, T_5 – 125% RDF + 25% less than normal spacing + soil application of $ZnSO_4$, T_6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP, T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ and $ZnSO_4$. The treatments were evaluated in Randomized Block Design with three replications. The soil is generally sandy loam with moderated fertility. The determination of mechanical and chemical composition of the soil and its fertility status, the soil of experimental field was sandy loam in texture having pH 7.8. the fertility status of field was low in organic carbon (0.48%) and medium in available phosphorus (16 kg/ha)and available potash (183 kg/ha).The cotton crop was sown on 28.05.2015 and harvested on 25-10-2015 and 10-11-2015 as first and second picking, respectively. The normal spacing was kept row to row distance of 67.5 cm and plant to plant distance of 30 cm. crop was fertilized as per respective treatments where half of nitrogen and full dose of phosphorus and potassium was applied at the time of sowing and remaining half of nitrogen was applied in two equal installment one at 30 days after sowing and second at 60 days after sowing. Optimum plant protection measures were adopted and applied insecticides as per need of crops. Observations are taken on growth characters yield and yield attributes quality characters. Harvesting was done on the basis of picking when bolls were fully opened. The fineness, maturity, fibre strength are known to be affected by factors such as drought, nutrients, season, stage of harvest, pests and diseases (Naryadayya, 1960). Productivity of cotton can considerably be improved by approximate fertilizer management. Fulfillment of nutritional requirements of the crop is essential for achieving the higher yields and fibre quality (Kalaichelvi, 2009 and Kumar *et al.*, 2011). [12] Use of optimum dose of fertilizers and timely control of insect pest as well as proper weed and water management Practices. Application of micronutrients through foliar application has shown importance for their efficient utilization of better performance of crop (Rathinavel *et al*., (1999) [17]. It also regulate the biochemical changes in seed and increase yield of

cotton (Chaudhary *et al*., (2001) [4]. Squaring, blooming and boll development are stages where cotton makes highest nutrients demand. Augmentation of nutrient supply through foliar application at such critical stages may increase yield of cotton (Bhatt and Nathu (1986) [2]. Jadhav *et al.* (2012) [7] recorded maximum net return with the application of 200:100:100 kg NPK/ha followed by 150:75:75 kg NPK/ha. The increase in economics such as gross and net monetary returns and benefit: cost ratio of cotton with the application of higher doses of fertilizers has also been reported by several workers (Solanki *et al.* 2012 [26]. The data were analyzed statistically by the computer. Statistical methods and test of significance appropriate to the design (Cochran and Cox, 1950) [5] were applied to the data for magnitude of the effects revealed to be significant of the 'F' test in the analysis of variation, summary tables giving the mean of treatment along with their standard errors were prepared. Appropriate critical differences were computer to test the significance between two treatments. Critical difference (CD) values at *P*=0.05 were used to determine the significance of differences between means.

Table 1A: Effect of spacing and nutrients management on growth parameters, in *Hirsutum* cotton

Treatments	No. of plants/plot	No. of plant population/ha	Plant height (cm)				
			30 DAS	60 DAS	90 DAS	120 DAS	150 DAS
T1 - Control without fertilizer + normal spacing	62.33	38476.7	25.00	47.67	68.20	93.80	109.93
T2 – 100% RDF + normal Spacing	73.33	45308.7	27.47	50.00	73.87	97.93	117.53
T3 – 100% RDF + 25% less than normal spacing	65.33	39683.3	28.00	51.13	72.40	96.53	114.80
T4 – 125% RDF + 25% less than normal spacing	76.33	41285.0	29.80	51.80	74.20	99.40	118.13
T_5 – 125% RDF + 25% less than normal spacing + Soil application of $ZnSO_4$ (20kg/ha)	77.33	45285.0	30.20	52.73	75.13	101.13	120.23
T6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea & 2% DAP	80.00	50724.3	31.60	56.00	77.47	105.20	124.60
T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ (1%) and $ZnSO_4$ (0.5%)	78.00	48504.3	30.26	55.27	76.13	102.33	122.13
S.E(d) ±	0.74	363.57	0.62	1.14	0.83	0.63	1.62
C.D. at 5%	1.61	792.15	1.34	2.48	1.82	1.37	3.52

Table 1B: Effect of spacing and nutrients management on growth parameters, in *Hirsutum* cotton.

Treatments	Monopodia /plant	Sympodia /plant	Fresh weight/plant	Dry weight/plant
T1 - Control without fertilizer + normal spacing	0.87	12.00	274.33	136.33
T2 – 100% RDF + normal Spacing	1.07	12.67	335.67	150.00
T3 – 100% RDF + 25% less than normal spacing	0.93	13.00	333.33	145.33
T4 – 125% RDF + 25% less than normal spacing	1.00	13.10	337.33	152.00
T_5 – 125% RDF + 25% less than normal spacing + Soil application of $ZnSO_4$ (20kg/ha)	1.40	13.20	346.67	153.00
T6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea & 2% DAP	1.13	13.47	388.67	158.33
T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ (1%) and $ZnSO_4$ (0.5%)	1.23	13.27	349.00	155.67
S.E(d) ±	0.08	0.11	3.56	2.25
C.D. at 5%	0.17	0.24	7.76	4.89

Table 2: Effect of spacing and nutrients management on yield attributes, yield attributes in *Hirsutum*cotton.

Treatments	No. of bolls/plant	No. of bolls/m^2	Bolls weight (g)
T1 - Control without fertilizer + normal spacing	13.93	66.06	3.13
T2 – 100% RDF + normal Spacing	17.80	89.33	3.25
T3 – 100% RDF + 25% less than normal spacing	15.87	80.76	3.25
T4 – 125% RDF + 25% less than normal spacing	19.53	95.13	3.26
T_5 – 125% RDF + 25% less than normal spacing + Soil application of $ZnSO_4$ (20kg/ha)	21.13	98.52	3.33
T6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea & 2% DAP	25.40	117.88	3.43
T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ (1%) and $ZnSO_4$ (0.5%)	23.47	102.29	3.39
S.E(d) ±	0.62	1.74	0.08
C.D. at 5%	1.35	3.80	0.17

Table 3A: Effect of spacing and nutrients management on yield and quality characters in *Hirsutum* cotton.

Treatments	Seed cotton yield (kg/ha)	Lint yield (kg/ha)	Cotton seed yield (kg/ha)	Stick yield (kg/ha)	Ginning out turn (%)	Span length 25% (mm)	Micronaire value (%)	Uniformity ratio (%)	Fibre strength (g/tax)
T1 - Control without fertilizer + normal spacing	746.67	261.8	485.33	4384.0	35.02	26.7	4.77	80.0	25.47
T2 – 100% RDF + normal Spacing	1199.33	422.9	777.67	5142.7	35.20	25.6	4.30	80.0	26.23
T3 – 100% RDF + 25% less than normal spacing	1144.00	404.2	740.33	4483.3	35.33	26.2	4.60	80.3	27.30
T4 – 125% RDF + 25% less than normal spacing	1250.00	430.9	819.67	5504.3	34.47	25.4	4.63	80.0	28.30
T_5 – 125% RDF + 25% less than normal spacing + Soil application of $ZnSO_4$ (20kg/ha)	1257.00	429.9	827.67	5733.0	34.20	26.1	4.47	79.7	27.50
T6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea & 2% DAP	1391.62	487.5	902.60	6388.7	35.63	26.2	4.83	80.0	26.37
T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ (1%) and $ZnSO_4$ (0.5%)	1259.33	448.0	811.67	5818.7	35.60	25.5	4.43	80.0	27.70
S.E(d) ±	58.65	19.80	39.10	46.22	0.18	0.13	0.78	0.78	0.14
C.D. at 5%	127.79	43.14	85.20	100.70	0.39	0.27	NS	NS	0.30

Table 3B: Effect of spacing and nutrients management on economics in *Hirsutum* cotton

Treatments	Gross return (Rs/ha)	Net return (Rs/ha)	Benefit: Cost Ratio
T1 - Control without fertilizer + normal spacing	43018.7	7541.7	1.21
T2 – 100% RDF + normal Spacing	63401.3	21500.3	1.51
T3 – 100% RDF + 25% less than normal spacing	59210.0	17309.0	1.41
T4 – 125% RDF + 25% less than normal spacing	66513.0	23889.0	1.56
T_5 – 125% RDF + 25% less than normal spacing + Soil application of $ZnSO_4$ (20kg/ha)	67479.0	24255.0	1.56
T6 – 125% RDF + 25% less than normal spacing + foliar spray of 2% urea & 2% DAP	74832.7	31891.7	1.74
T_7 – 125% RDF + 25% less than normal spacing + foliar spray of $MgSO_4$ (1%) and $ZnSO_4$ (0.5%)	67829.3	25005.3	1.58
S.E(d) ±	2312.26	2311.88	0.06
C.D. at 5%	5038.02	5037.20	0.12

Results and Discussion

Growth characters viz., number of plants, plant height at 30, 60, 90, 120 and 150 days after sowing, number of sympodial and monopodial branches/plant, fresh and dry weight/plant of cotton was significantly influenced with different spacing and nutrient management systems increased with increasing doses of fertilizers. Application of 125% recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea 2% DAP significantly increased plant height of cotton at all the physiological stages of crop growth as compared to rest of the doses of spacing and nutrient management. Increasing plant height of cotton with spacing and nutrient management have been reported by Kaur *et al.* (2010) [9] and Sharma *et al.* (2004) [21]. Higher plant height recorded in closer spacing was due to congestion in the growing crop plants with reduces more vertical growth and later spaced was restricted. Reddy and Kumar (2010) [20]

Significantly higher number of monopodia plant was obtained with the application 125% recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP as compared to rest of the levels of spacing and nutrient management. Increasing dose of fertilizers with wider spacing increased number of sympodial branches/plant of cotton however, it could rest reached to the level of significance. The increased in monopodial and sympodia might be due to the fact the optimum nutrient helped in cell division and cell elongation leading to increased number of lateral branches. These results are close conformity with the findings of Ram and Giri (2006) [16] and Kaur *et al.* (2010) [9].

Increasing dose of fertilizers at wider spacing significantly influenced fresh and dry weight/plant of cotton. Significantly highest fresh and dry weight/plant was produced with the application of 125% RDF +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP as compared to lower doses of fertilizers with wider spacing. Application of 125% RDF +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ significantly increased fresh and dry weight/plant of cotton as compared to lower levels of nutrient management with normal spacing. The increase in fresh and dry weight of plant might be due to increase in meristematic activity of plant. Similar results have also been reported by Jadhav *et al.* (2012) [7].

Application of 125% RDF +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP significantly increased number of bolls/plant, number of boll/m^2 and boll weight of cotton as compared to lower doses of fertilizers and normal spacing. Significantly higher number of bolls/plant and boll weight of cotton was obtained with 125% RDF +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ than the other treatments. The increase in number of bolls/plant, number of boll/m^2 and boll weight of cotton might be due to the fact that increase in growth attributes viz plant height, number of monopodial and sympodial branches, fresh and dry weight of cotton. These findings are corroborate with the results of Jadhav *et al.* (2012) [7].

Application of 125% recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP increased significantly higher seed cotton yield to the extent of 86.38 per cent as compared to control without fertilizer with normal spacing. Significantly higher seed cotton yield was also produced with the application of 125% RDF +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ as compared to control. Application of higher doses of fertilizers i.e. 125% RDF +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ significantly increased lint yield of cotton as compared to without nutrient management + normal spacing. Significantly higher lint yield of cotton was obtained with the application of 125% RDF +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP as compared to rest of the levels of nutrient spacing. Significantly higher cotton seed yield of cotton was produced with the application of 125% recommended dose of fertilizer

+25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ as compared to control. Application of 125% recommended dose of fertilizers produced +25% less than normal spacing+ foliar spray of 2% urea 2% DAP significantly highest stick yield of cotton was obtained as compared to rest of the doses of fertilizers with spacing. The minimum seed cotton, lint, seed and stick yield of cotton in obtained with control without fertilizer + normal spacing. The increased in yields (seed cotton, lint, seed and stick) of cotton with the application of higher doses of fertilizers might be due to increase in growth and yield attributing characters of cotton. Similar observations were made by Bhattoo *et al.* (2012) [3]. Raskar (2004) [19] reported that progressive increase in fertilizer levels from 50 to 100 per cent RDF resulted in the significant increase in seed cotton yield. The yield increase by application of 100 per cent RDF was 31.71 and 10.16 per cent higher over 50 and 75 per cent RDF, respectively. The overall improvement in yield attributing characters was responsible for higher cotton yield in increasing levels of fertilizers. Kote *et al.* (2005) [10] reported that the application of 100 per cent of recommended dose of fertilizers produced significantly higher seed cotton yield and cotton seed yield of cotton as compared to 75 per cent and 50 per cent recommended dose of fertilizers. Those results are in accordance with the findings of Bhaskar (1993) [1]. Significant increase seed cotton yield ata wider spacing have been reported by Kumar *et al.* (2010) [11].

Application of different nutrient management system significantly influenced on quality characters viz., ginning out turn, span length, fibre strength, micronaire value and uniformity ratio of cotton. Application of 125 percent of recommended dose of fertilizers +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ produced significantly more ginning out turn of cotton as compared to rest of the doses of nutrient management with spacing. Significantly higher ginning out turn was also recorded with the application of 125 per cent recommended dose of fertilizers +25% less than normal spacing than the other treatments. Span length of cotton was significantly increased in control without fertilizer + normal spacing as compared to rest of the treatment combinations. Significantly higher span length of cotton was also recorded with the application of 125 per cent recommended dose of fertilizers +25% less than normal spacing than 125% RDF + 25% less than normal spacing. Application of 125 per cent recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% and urea 2% DAP produced higher micronaire value and uniformity ratio of cotton followed by control without fertilizer + normal spacing. The minimum quality characters viz., ginning out turn, span length, micronaire value, uniformity ratio, fibre strength of cotton was obtained in without nutrient application + normal spacing. These results are in accordance with the results of Srinivasul *et al.* (2008)**.** Rao and Janawade (2009) [18] reported that the ginning out turn and lint index was incurred with the application 100 per cent of recommended dose of fertilizers followed by 75 per cent RDF and 50 per cent RDF.

Application of nutrient management with spacing significantly influenced gross and net return and benefit: cost ratio of cotton. Significantly highest gross return of cotton was fetched with the application of 125 per cent recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP as compared to rest of the treatments. Application of 125% RDF +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ also produced significantly higher gross return as compared to other nutrients. Significantly higher gross return of cotton was realized with the application of 125 per cent recommended dose of fertilizers +25% less than normal spacing+ soil application of $ZnSO_4$ than the other nutrient management. Significantly higher net returns of cotton was fetched with the application of 125 per cent recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP as compared to rest of the nutrients combination and was at par with 125 per cent RDF +25% less than normal spacing+ soil application of $ZnSO_4$ and 125% RDF + 25% less than normal spacing. Application of 125 per cent recommended dose of fertilizers +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ produced significantly more net return of cotton than the other nutrient management. Net return was significantly increased with the application of 125 per cent of recommended dose of fertilizers +25% less than normal spacing than control without fertilizer with normal spacing. Application of different nutrient management system and spacing significantly influenced benefit: cost ratio of cotton. Application of 125 per cent of recommended dose of fertilizers +25% less than normal spacing+ foliar spray of 2% urea and 2% DAP registered maximum benefit: cost ratio of cotton followed by 125 per cent +25% less than normal spacing+ foliar spray of $MgSO_4$ + $ZnSO_4$ and 125 per cent of recommended dose of fertilizers +25% less than normal spacing+ soil application of $ZnSO_4$. The minimum gross and net return and benefit: cost ratio of cotton in recorded with control without fertilizer + normal spacing. The increase in gross and net monetary returns and benefit: cost ratio of cotton might be due to increase in seed cotton yield with the application of higher recommended dose of fertilizers and closer spacing. Jadhav *et al.* (2012) [7] recorded maximum net return with the application of 200:100:100 kg NPK/ha followed by 150:75:75 kg NPK/ha. The minimum net return was realized with the application of 100:50:50 kg NPK/ha. The increase in economics such as gross and net monetary returns and benefit: cost ratio of cotton with the application of higher doses of fertilizers has also been reported by several workers (Solanki *et al.* 2012; Gangvir *et al.* 2012; and Powar *et al.* 2010) [25, 26].

On the basis of above results, it may be concluded that *Hirsutum* cotton genotype H-1300 along with application of 125% recommended dose of fertilizers (60:30:20 kg NPK/ha) + 25% less than normal spacing + foliar spray of 2% urea and 2% DAP was most productive and remunerative and cost effective for cotton under Central Plain Zone of U.P.

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