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Nitrogen management schedule for *Bt* cotton under different planting geometries in semi-arid north-western plains of India

Ramanjit Kaur[1], Anchal Dass[2] and V.P Verma[3]

Division of Agronomy, ICAR-Indian Agricultural Research Institute, New Delhi-110 012
e-mail: ramaan180103@yahoo.com

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Abstract

Cotton occupies a predominant position amongst all cash crops in India. However, the full proof agronomic practices are still lacking, particularly for *Bt.* cotton. Therefore, a field experiment was conducted at research farm of ICAR-IARI, New Delhi during kharif seasons of 2013 and 2014 to determine precise nitrogen (N) application rate and planting geometries for *Bt.* Cotton. The treatments consisted of four planting geometries viz., 75 × 60 cm (R), 75 × 45 cm, 60 × 45 cm and 90 × 60 cm and five N-application methods *viz.*, recommended dose of N (RDN), site specific nutrient management using SPAD meter (SPAD index <35), (SSNM), soil test crop response (STCR) approach (140 kg/ha), GreenSeeker (0.67 NDVI) and N-rich strip. The results showed that the highest seed cotton yield (2.13 t/ha) was recorded in N-rich strip where 25 kg N/ha more N was applied as compared to the RDN and this treatment was successively followed by the treatment where N was applied at NDVI 0.67 (2.01 t/ha) and these two treatments were statistically at par with each other. Among different planting geometries studied, the highest seed cotton yield, leaf area, leaf area index, dry matter, number of bolls/plant, number of sympodial branches plant^{-1} were recorded with 75 × 60 cm planting geometry. Thus SPAD meter and GreenSeeker aided site specific N application and planting spacing 75 × 60 cm can be adopted for improving *Bt.* cotton productivity in the north-western plains of India.

Key words: *Bt* Cotton, SPAD meter, Greenseeker, planting geometries

Cotton *(Gossypium hirsutum)* is mainly grown for fiber purpose, however it has many valuable uses as its seed comprises of 30% starch, 25% crude oil and 16.2% protein (Cobley and Steel, 1976). In India cotton is grown over an area of 12.5 mha with total production of 0.34 m cotton bales. *Bt*-cotton accounts for 90% of total cotton area in the country. Nitrogen (N) management in the cotton is one of the most important practices to obtain high-yield and quality fiber. Both deficiency and excess of N adversely affect plant growth and development, retention of bolls, seed cotton yield, lint yield and quality of fiber. An under application of N can cause detrimental losses to yield proportional to the fertilizer shortfall, depletion of the soil N reserve, and depletion of soil fertility (Nichols and Green, 2003). Over-fertilization results in excessive vegetative growth, decreased lint turnout, increased wilt disease incidence, delay in maturity which may results in immature fiber, adversely affecting lint yield and fiber quality (Main *et al.*, 2011; Main *et al.*, 2010). Application of N more than recommended dose not only increases production costs, but also causes severe environmental problems, like groundwater contamination by NO_3- leaching, *etc.* (Zhao *et al.*, 2009; Hunt *et al.*, 1997). The N requirements of cotton plant are not constant throughout the crop growth. At early stage of crop, only a small amount of N is required for vegetative growth, which is generally less than 25% of the total quantity of N required by crop in entire season (Guthrie, 1991).