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# Assessment of Planting Methods in Bidi Tobacco (*Nicotiana tabacum* L.) to Minimize the Effect of Water Logging under Rainfed Conditions in Vertisols of Andhra Pradesh, India

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**A B S T R A C T**

A field experiment was undertaken at Regional Agriculture Research Station, Nandyal, Andhra Pradesh during 2017-18 on vertisols under rainfed condition to find out the suitable method of planting to avoid water logging for higher cured leaf yield in bidi tobacco (*Nicotiana tabacum* L.). The treatments consisted of two planting methods (Ridge method and flat bed method) as one factor and four planting geometry (60 cm x 50 cm, 60 cm x 75 cm, 75 cm x 50 cm and 75 cm x 75 cm) as another factor in factorial randomized block design and replicated thrice. The bidi tobacco variety used for experimentation is Nandyal Pogaku-1. Soil moisture was higher under ridge method when compared to flat method at all intervals except at 45 DAP. SPAD readings recorded do not show significant changes due to different treatments except variation in readings at different intervals. Ridge planting method recorded significantly higher leaf length (39.0 cm), leaf width (14.3 cm), cured leaf yield (1550 kg $ha^{-1}$) against flat bed method planting (37.3 cm, 13.5 cm and 1359 kg $ha^{-1}$). Significantly higher cured leaf yield was recorded with 60 cm x 75cm (1521 kg $ha^{-1}$) was on par with 75 cm x 50 cm (1490 kg $ha^{-1}$) and 75 cm x 75 cm (1423 kg $ha^{-1}$). Higher leaf length 39.8 cm) and leaf width (15.0 cm) was observed at 75 x 75 cm planting. Interaction effect with planting method and spacing found non significant. Higher net returns was observed in ridge method (Rs 79,225/ ha) with BCR of 2.77 whereas planting at 60 cm x 75 cm geometry recorded net returns of Rs 78,405/ha with BCR of 2.81.

## Introduction

Tobacco (*Nicotiana tabacum* L.) is the most important non-food crop cultivated in more than 100 countries. It is one of the most important commercial crops of India, valued for its leaf containing nicotine. It is grown over an area of 0.46 million ha with production of 0.84 million tones with productivity of 1842 kg/ha (Agriculture statistics at a glance 2016 at www.agricoop.nic.in & http://

eands.dacnet.nic.in). In Andhra Pradesh, bidi tobacco is commercially cultivated under rainfed black soils in late rainy season i.e., September ($2^{nd}$ fortnight) month. The rainfed agriculture suffers from a number of hydro-physical and socio-economic constraints, which affect the productivity of rainy and post-rainy season crops. These include erratic and undependable rainfall, excess and deficient moisture within a season, harsh thermal regime, soil loss, low level of input use and technology adoption and resource poor farmers (Gupta, 2002). After few showers the monsoon rains in July – August and September are usually heavy and frequent. Under such situation water logging is a common problem which affects early growth, root proliferation and final yield performance of crop. Extreme variability in the quantity, time and duration of rains expose the soybean crop to soil moisture deficit as well as excess moisture either on account of delayed monsoon, longer dry spells or early withdrawal mansoon has been identified as one of the major factors for poor performance of soybean crops (Tiwari, 2014; Gupta *et. al.*, 2018). Studies on soil management for increasing crop production revealed that use of various tillage methods and modification of land configurations such as broad bed furrow, ridges and furrow for soybean in vertisols were superior over flat bed and recommended in watershed development for moisture conservation as well as for safe removal of excess rain water (Raut and Taware, 1997). There is a need for in-situ soil and water conservation and proper drainage technology in black soils. This technology has many advantages including in-situ conservation of rainwater in furrows, better drainage of excess water and proper aeration in the ridge and root zone. Besides, other techniques the *In-situ* conservation of rainwater at farm level by adopting holistic approach to the management of rainwater like broad-bed and furrow, ridge and furrow, tied ridging, raised and sunken bed and compartmental bunding etc. by which crop productivity is substantially increased. Land treatments (raised sunken bed system, ridges and furrows, broad bed and furrows) increased *in situ* soil moisture conservation, minimized runoff, and soil erosion (Nagavallemma *et al.*, 2005). Hari Ram *et al.*, 2012 concluded that raised bed, raised broad bed and ridge furrow sowing of soybean should be advocated over flatbed sowing mainly due to their ability to save irrigation water. Plant spacing is required for the optimum yield. Closer spacing of plants resulted in reduction of size, body, thickness and weight per unit area of the leaf, Price of tobacco grown at higher plant densities was also lower, resulting in lower income from such production observed a decrease in total leaf area per plant with increased plant population Bukan *et al.*, (2010). Regulate the optimal density is one of the important factors to get the maximum yield due to the climatic conditions of each region and specifications of varieties are cultivated. Alizadeh *et al.*, (2013) studied the effect of plant spacing on tobacco yield of Barley variety. They observed that there is a negative relationship between plant spacing and yield. In view of the above fact the study was undertaken to find out the suitable method of planting to avoid water logging for higher cured leaf yield of bidi tobacco.

## Materials and Methods

A field experiment was undertaken at Regional Agriculture Research Station, Nandyal, Andhra Pradesh during 2017-18 on vertisols under rainfed condition to find out the suitable method of planting to avoid water logging for higher cured leaf yield of bidi tobacco (*Nicotiana tabacum* L.). The soil of experimental site was medium deep black, moderately alkaline (pH-8.2), non saline (EC-0.11 ds/m), low in nitrogen (152.3 kg $ha^{-1}$), medium in available $P_2O_5$ (32.5 kg $ha^{-1}$) and

high in available $K_2O$ (350.9 kg $ha^{-1}$). The treatments consisted of two planting methods (Ridge method and flat bed method) as one factor and four planting geometry (60 cm x 50 cm, 60 cm x 75 cm, 75 cm x 50 cm and 75 cm x 75 cm) as another factor in factorial randomized block design and replicated thrice. The bidi tobacco variety used for experimentation is Nandyal Pogaku-1. Crop management practices like land preparation, N, P and K fertilizer application, weed control, intercultivation, need based plant protection, de suckering and sun curing were followed as recommended for local area. The nursery was raised on 26-07-17 and healthy seedlings were transplanted on 14-09-17. The crop was harvested on 06-02-18. The experiment was conducted under rainfed condition. An amount of 519.6 mm of rainfall was received during crop season (July to December) during 2017. Rainfall distribution was highly erratic coupled with prolonged dry spells i.e. 307 mm in 17 rainy days in nursery and 212.6 mm in 13 rainy days in standing crop after transplanting. The data were recorded on soil moisture and quantitative traits such as plant height, leaf length, leaf width and cured leaf yield at harvest. Leaf quality parameters like nicotine and reducing sugars were analysed at CTRI, Rajahmundry. The mean values of all the quantitative characters were subjected to statistical analysis by adopting Fisher's method of analysis of variance as outlined by Gomez and Gomez (1984). The level of significance used in 'F' test was at 5 per cent.

## Results and Discussion

### Soil moisture

Soil moisture was higher under ridge method (19.6%, 24.7%, 14.3% and 12.6% at 15 DAP, 30 DAP, 60 DAP and 90 DAP) when compared to flat method (17.6%, 21.2%, 12.1% and 10.6% at 15 DAP, 30 DAP, 60 DAP and 90 DAP) at all intervals except at 45 DAP (Table 1 and Fig. 1.).

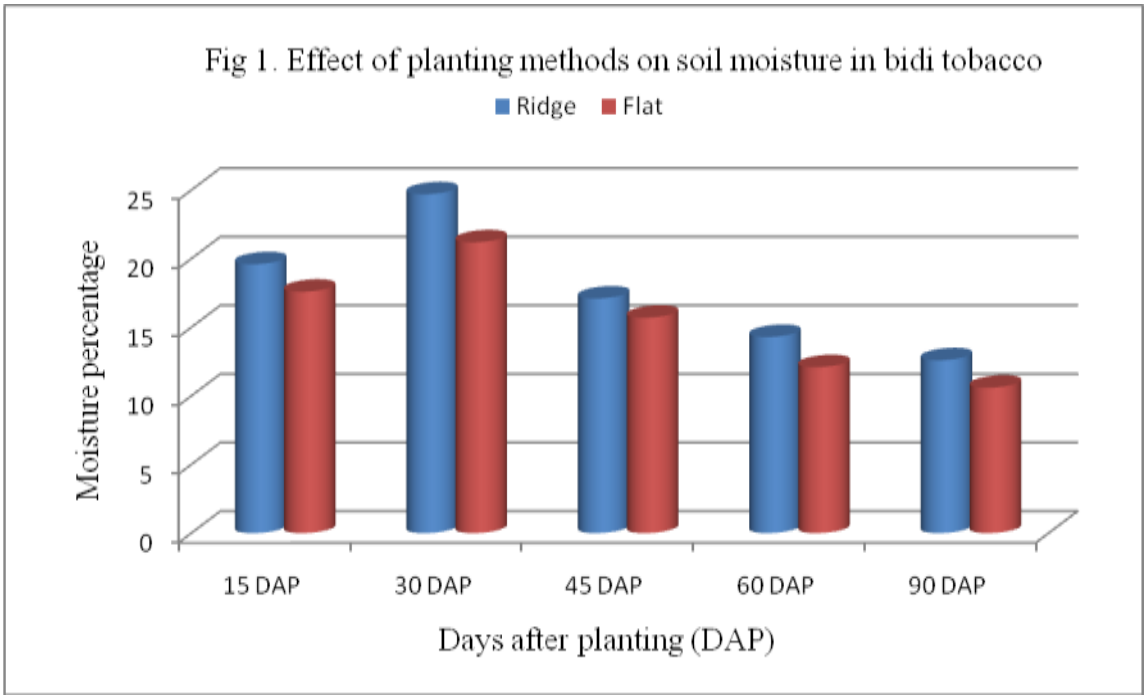
**Table.1** Effect of planting methods and planting geometry on soil moisture in bidi tobacco

| Treatment | Soil moisture (%) | | | | |
|---|---|---|---|---|---|
| | 15 DAP | 30 DAP | 45 DAP | 60 DAP | 90 DAP |
| **Planting methods** | | | | | |
| **Ridge method** | 19.6 | 24.7 | 17.1 | 14.3 | 12.6 |
| **Flat method** | 17.6 | 21.2 | 15.7 | 12.1 | 10.6 |
| **S.Em±** | 0.43 | 0.67 | 0.61 | 0.40 | 0.43 |
| **C.D.(P=0.05)** | 1.3 | 2.0 | NS | 1.2 | 1.3 |
| **Planting geometry** | | | | | |
| **60cmx50cm** | 18.1 | 22.3 | 15.9 | 12.8 | 11.4 |
| **60cmx75cm** | 18.5 | 22.8 | 15.9 | 13.2 | 11.3 |
| **75cmx50cm** | 18.4 | 23.1 | 16.8 | 13.3 | 11.3 |
| **75cmx75cm** | 19.5 | 23.7 | 17.0 | 13.3 | 12.3 |
| **S.Em±** | 0.61 | 0.95 | 0.86 | 0.57 | 0.61 |
| **C.D.(P=0.05)** | NS | NS | NS | NS | NS |
| **Interaction** | NS | NS | NS | NS | NS |

**Table.2** Assessment of planting methods and planting geometry on growth, cured leaf yield, economics and leaf quality of bidi tobacco

| Treatments | Plant height (cm) | Leaf length (cm) | Leaf width (cm) | Cured leaf yield (kg/ha) | Gross returns (Rs/ha) | Cost of cultivation (Rs/ha) | Net returns (Rs/ha) | BCR | Nicotine (%) | Reducing sugars (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| **Planting methods** | | | | | | | | | | |
| **Ridge method** | 52.1 | 39.0 | 14.3 | 1550 | 124000 | 44775 | 79225 | 2.77 | 4.68 | 2.59 |
| **Flat method** | 46.3 | 37.3 | 13.5 | 1359 | 108720 | 42775 | 65945 | 2.54 | 4.33 | 2.62 |
| **S.Em±** | 2.28 | 0.16 | 0.08 | 25.7 | | | | | 0.17 | 0.11 |
| **C.D.(P=0.05)** | NS | 0.50 | 0.2 | 80 | | | | | NS | NS |
| **Planting geometry** | | | | | | | | | | |
| **60cmx50cm** | 42.9 | 36.6 | 12.9 | 1383 | 110640 | 43775 | 66865 | 2.53 | 4.71 | 2.64 |
| **60cmx75cm** | 47.6 | 37.8 | 13.4 | 1521 | 121680 | 43275 | 78405 | 2.81 | 4.39 | 2.52 |
| **75cmx50cm** | 51.5 | 38.4 | 14.2 | 1490 | 119200 | 43475 | 75725 | 2.74 | 4.61 | 2.56 |
| **75cmx75cm** | 54.8 | 39.8 | 15.0 | 1423 | 113840 | 42775 | 71065 | 2.66 | 4.33 | 2.70 |
| **S.Em±** | 3.22 | 0.23 | 0.11 | 35.3 | | | | | 0.25 | 0.14 |
| **C.D.(P=0.05)** | NS | 0.71 | 0.3 | 105 | | | | | NS | NS |
| **Interaction** | NS | NS | NS | NS | | | | | NS | NS |

**Fig.1**




No significant change in soil moisture among different spacings at different intervals. Comparatively higher moisture was recorded with plant geometry of 75 cm x 75 cm whereas lower moisture was recorded with 60 cm x 50 cm.

## Planting methods

Plant height did not differed with planting methods (Table 2). Ridge planting method recorded significantly higher leaf length (39.0 cm), leaf width (14.3 cm), cured leaf yield (1550 kg $ha^{-1}$) against flat bed method planting (37.3 cm, 13.5 cm and 1359 kg $ha^{-1}$). Ram *et al.*, (2011) also concluded that ridge and furrow sowing of soybean should be advocated over flatbed sowing mainly due to their ability to save irrigation water.

Kumari and Rao (2005) reported that the crop growth rate and net assimilation rate were higher when crops are planted on ridge and furrow or bed planting system for mustard. Jadav *et al.*, (2012) and Dhakad *et al.*, (2015) found higher growth parameters, yield and yield attributes parameters in ridge and furrow system over flat sowing system in soybean. Similar trends reported by Bhargav *et al.*, (2013).

## Planting geometry

Plant height did not differed with planting geometry (Table 2). Significantly higher leaf length (39.8 cm) and leaf width (15.0 cm) was recorded with plant geometry of 75 cm x 75 cm whereas lower leaf length (36.6 cm) and leaf width (12.9 cm) was recorded with plant geometry of 60 cm x 50 cm. Significantly higher cured leaf yield was recorded with 60 cm x 75cm (1521 kg $ha^{-1}$) was at par with 75 cm x 50 cm (1490 kg $ha^{-1}$) and 75 cm x 75 cm (1423 kg $ha^{-1}$). Interaction effect with planting method and spacing found non significant. The possible reason for this could be due to the genetic adoptability of tobacco hybrids to T3 spatial arrangement Kharazmi *et al.*, (2014) and also similar results were reported by Bukan *et al.*, (2010).

## Economics

Higher net returns (Rs 79,225/ ha) with BCR of 2.77 was observed in ridge method and in planting at 60 x 75 cm spacing (Rs 78,405/ha and BCR of 2.81). Similar results reported by Bhargav *et al.*, (2013) and Dhakad *et al.*, (2015). They concluded that the higher gross as well as net monetary returns were recorded under ridge and furrow planting as compared conventional system.

## Leaf quality parameters

Leaf nicotine and reducing sugars did not differed with treatments and are in permissible limits.

In conclusion, bidi tobacco planting at plant geometry of 60 x 75 cm under ridge planting is optimum for higher moisture conservation, cured leaf yield, leaf quality and net returns.

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