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**Original Research Article**

# Effect of Foliar Spray of Nitrogen and Potash on Growth, Yield and Economics of Hybrid Bidi Tobacco

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

A field experiment was conducted in *kharif-rabi* season of the year 2019-2020 at Bidi Tobacco Research Station, Anand Agricultural University, Anand, to study "Effect of foliar spray of nitrogen and potash on growth and yield of hybrid bidi tobacco". The soil of the experimental field was loamy sand in texture. There were nine treatments *viz.*, $T_1$ (RDN @180 kg $ha^{-1}$), $T_2$ (RDN *fb* foliar spray of 2% Urea at 45 and 60 DATP), $T_3$ (RDN *fb* foliar spray of 2% SOP at 45 and 60 DATP), $T_4$ (RDN *fb* foliar spray of 2% Urea + foliar spray of 2% SOP tank mix at 45 and 60 DATP), $T_5$ (RDN *fb* foliar spray of 2% $KNO_3$ at 45 and 60 DATP), $T_6$ (75% RDN *fb* foliar spray of 2% Urea at 45 and 60 DATP), $T_7$ (75% RDN *fb* foliar spray of 2% SOP at 45 and 60 DATP), $T_8$ (75% RDN *fb* foliar spray of 2% Urea + foliar spray of 2% SOP tank mix at 45 and 60 DATP), $T_9$ (75% RDN *fb* foliar spray of 2% $KNO_3$ at 45 and 60 DATP) were studied in Randomized Block Design with four replications. The analyzed results of the experiment revealed that, plant height recorded at 60 and 90 days after transplanting (DATP) as well as at harvest were not affected significantly due to foliar spray treatments. Higher value of growth characters and yield viz., Periodical leaf length and width at 60 and 90 DATP as well as at harvest, dry leaf weight per unit leaf area and cured leaf yield were recorded under treatment $T_5$ which was at par with $T_2$, $T_4$ and $T_3$ treatments. Higher value of net return and benefit cost ratio also found under same treatment.

**Keywords**

Bidi tobacco, Foliar spray, Nitrogen, Potash

## Introduction

Tobacco belongs to the family *solanaceae* or the night shade family and the genus *Nicotiana*. This plant is considered one of the few crops entering world trade entirely on the leaf basis and most widely grown commercial non-food plant in the world. It is an important commercial crop in view of revenue generation, export earnings and employment potential. It is called the golden leaf of India. Commercially important species are *Nicotiana tabacum* L. and *Nicotiana rustica* L.

Tobacco (*Nicotiana tabacum* L.) is cultivated in more than 100 countries. The major tobacco growing countries in the world are China, India, USA, Brazil, Turkey, Russia, Italy and Zimbabwe. India occupied 3rd rank with production of 7-8% of world's tobacco. Tobacco is an important foreign exchange earner grown over 0.47 million hectares, accounting for 0.32% of the total arable land

in the country, which having the production of 0.8 million tones with productivity of 1711 kg $ha^{-1}$ in the year 2017 (Reddy *et al.,* 2019). Among various types of tobacco, bidi tobacco shares about 30% of the total tobacco area and about 40% of tobacco production in the country. Gujarat occupies first place from productivity view point followed by Andhra Pradesh. In Gujarat, tobacco is cultivated in around 1.77 lakh ha, the major type being bidi tobacco. Total production comes to about 263 million kg with a productivity of 1658 kg per ha (Anon. 2019). 90% of tobacco grown in the state is accounted by bidi tobacco. The production of bidi tobacco in Gujarat is largely concentrated in Middle Gujarat Zone.

Balanced N-K fertilization enhances tobacco growth and improves the uptake of both nutrients, which in turn reduces the nitrate losses during and after the cropping season. Nitrogen is one of the elements which is needed in all parts of plant life. Nitrogen is a very important element in growth and quality of tobacco leaf. Potassium is an important nutrient for plant meristematic growth and physiological functions, including regulation of water and gas exchange in plants, protein synthesis, enzyme activation, photosynthesis and carbohydrate translocation in plants. This attributed to the role of K in biochemical pathways in plants and it increases the photosynthetic rates, $CO_2$ assimilation and facilitates carbon movements (Sangakkara *et al.,* 2000). Potassium has favourable effects on metabolism of nucleic acids, proteins, vitamins and growth substances (Bisson *et al.,* 1994; Bednarz and Oosterhuis, 1999). Tobacco requires a large amount of potassium to reach a healthy and mature plant. Most of K is taken up during the vegetative growth and developmental stages of plants, when roots are more active than in reproductively growth stages (Mills and Jones, 1996 and Marschner, 1998).

Foliar fertilization is very frequently applied in agriculture and also recommended in an integrated plant production component because it is eco friendly and helps to achieve high productivity with good quality and it is also helpful when plants are too large with their growth and difficulty to side dressing. For nutrients which are phloem mobile, the efficiency of this measure is particularly successful. According to Doring and Gericke (1986) and Tukey and Marczyński (1984), a combined soil and foliar fertilization should be recommended in crop production to increase both crop productivity and yield quality.

Foliar application of fertilizer is an important method because plants can absorb the nutrients much quicker, and smaller quantities may be required for normal growth as against the large quantities of the same generally required for soil application (Mudaliar, 1959). The efficiency of foliar fertilization depends on nutrient mobility within a plant. However, crop physiologists have recently developed the technique of foliar application to the agricultural crops (Smolen and Sady, 2009). Foliar application of nitrogen and potassium is more suitable, target oriented and economical technique for increasing the fertilizer use efficiency and grain yield over soil application (Farooqi *et al.,* 2012).

## Materials and Methods

A field experiment was conducted during *kharif-rabi* season of the year 2019-2020 at Bidi Tobacco Research Station, Anand Agricultural University, Anand (Gujarat). The soil of the experimental field was loamy sand in texture, low in organic carbon (0.29%) and available nitrogen (173 kg $ha^{-1}$), medium in available phosphorus (55 kg $ha^{-1}$) and high in available potassium (310 kg $ha^{-1}$) with slightly alkaline (pH 7.98) in reaction.

The nine treatments viz., $T_1$(RDN @180 kg $ha^{-1}$), $T_2$ (RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP),$T_3$ (RDN *fb* Foliar spray of 2% SOP at 45 and 60 DATP), $T_4$ (RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP), $T_5$ (RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP), $T_6$ (75% RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP), $T_7$ (75% RDN *fb* Foliar spray of 2% SOP at 45 and 60 DATP), $T_8$ (75% RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP), $T_9$ (75% RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP) were studied in Randomized Block Design with four replications. Recommended dose of nitrogen (RDN) was applied in four equal splits; $1^{st}$ as basal through Ammonium sulphate and remaining three equal splits through Urea at 30 days interval after transplanting. Bidi tobacco hybrid variety GABTH 2 was selected for the present experiment. It has dark green foliage, more number of leaves, spangle score and puckering capacity with a yield potential of 3948 kg $ha^{-1}$. Crop was transplanted in second week of September and harvested in fourth week of Feb. to third week of March by ghugaro method. The collected data for various parameters were statistically analyzed using Fishers analysis of variance (ANOVA) technique and the treatments were compared at 5% levels of significance.

## Results and Discussions

### Effect on growth

Plant height recorded at 60, 90 DATP and at harvest was not affected significantly due to foliar spray treatments. Periodical data of leaf length recorded at 60, 90 DATP and at harvest were influenced due to foliar spray treatments. Treatment $T_5$ (RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP) recorded significantly higher leaf length at 60 DATP (42.10 cm), at 90 DATP (45.20 cm) and at harvest (59.75 cm) but it was statistically at par with $T_2$ (RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP), $T_4$ (RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP) and $T_3$(RDN *fb* Foliar spray of 2% SOP at 45 and 60 DATP) treatments. Significantly lower leaf length at 60 DATP (35.69 cm), at 90 DATP (39.79 cm) and at harvest (50.03 cm) was recorded in treatment $T_1$ (RDN - 180 kg $ha^{-1}$).

Treatment $T_5$ (RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP) was recorded significantly higher leaf width at 60 DATP (18.20 cm), at 90 DATP (20.04 cm) and at harvest (24.58 cm) and it was statistically at par with $T_2$ (RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP), $T_4$ (RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP) and $T_3$ (RDN *fb* Foliar spray of 2% SOP at 45 and 60 DATP) treatments. Significantly lower leaf width at 60 DATP (14.72 cm), at 90 DATP (16.18 cm) and at harvest (20.40 cm) was recorded in treatment $T_1$ (RDN). Those results are in agreement with the results obtained by Fawzy *et al.,* (2007) in eggplant, Dkhil *et al.,* (2011) in potato and Basha *et al.,* (2019) in tobacco. Significantly higher dry leaf weight per unit leaf area(13.17 mg $cm^{-2}$) was recorded in treatment $T_5$ (RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP) which was statistically at par with$T_4$ (RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP), $T_3$ (RDN *fb* foliar spray of 2% SOP at 45 and 60 DATP) and $T_2$ (RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP) treatments.

On the conflicting results, significantly lower dry leaf weight per unit leaf area (10.96 mg $cm^{-2}$) was observed in $T_1$ (RDN @180 kg $ha^{-1}$) (Table 1).

**Table.1** Effect of different foliar spray treatments of on growth, yield and economics of hybrid bidi tobacco

| Trt. | Plant height (cm) | | | Leaf length (cm) | | | Leaf width (cm) | | | dry leaf weight per unit leaf area (mg cm$^{-2}$) | Yield (kg ha$^{-1}$) | Net returns (Rs. ha$^{-1}$) | BCR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 60 DATP | 90 DATP | At harvest | 60 DATP | 90 DATP | At harvest | 60 DATP | 90 DATP | At harvest | | | | |
| $T_1$ | 28.90 | 58.80 | 91.80 | 35.69 | 39.79 | 50.03 | 14.72 | 16.18 | 20.35 | 10.96 | 3373 | 105901 | 3.00 |
| $T_2$ | 33.78 | 64.85 | 103.90 | 39.72 | 44.60 | 57.30 | 17.98 | 19.42 | 23.85 | 12.13 | 4310 | 146609 | 3.60 |
| $T_3$ | 29.65 | 59.60 | 97.75 | 38.77 | 43.40 | 55.08 | 17.07 | 18.62 | 22.28 | 12.25 | 4000 | 130313 | 3.24 |
| $T_4$ | 32.08 | 62.60 | 100.15 | 39.58 | 43.45 | 57.15 | 17.23 | 18.95 | 22.48 | 12.43 | 4141 | 136826 | 3.35 |
| $T_5$ | 33.93 | 65.95 | 105.30 | 42.10 | 45.20 | 59.75 | 18.20 | 20.04 | 24.58 | 13.17 | 4523 | 154535 | 3.64 |
| $T_6$ | 33.30 | 60.45 | 98.60 | 36.75 | 41.00 | 53.35 | 16.02 | 17.87 | 21.60 | 12.00 | 3768 | 122818 | 3.24 |
| $T_7$ | 31.73 | 59.05 | 102.40 | 35.97 | 40.90 | 53.88 | 15.30 | 16.52 | 21.08 | 11.65 | 3666 | 116323 | 3.06 |
| $T_8$ | 32.35 | 59.60 | 101.50 | 37.19 | 41.17 | 53.78 | 15.85 | 17.28 | 21.30 | 11.97 | 3678 | 116757 | 3.06 |
| $T_9$ | 29.28 | 59.80 | 95.85 | 37.00 | 39.92 | 51.28 | 16.19 | 17.25 | 20.70 | 11.64 | 3582 | 111943 | 2.97 |
| S.Em.± | 1.45 | 2.21 | 3.21 | 1.31 | 1.30 | 1.76 | 0.64 | 0.54 | 0.79 | 0.37 | 223.3 | - | - |
| C.D. (P=0.05) | **NS** | **NS** | **NS** | **3.82** | **3.80** | **5.15** | **1.85** | **1.58** | **2.32** | **1.09** | **651** | - | - |
| C.V. % | 9.17 | 7.23 | 6.44 | 6.87 | 6.17 | 6.46 | 7.70 | 6.01 | 7.21 | 6.23 | 11.47 | - | - |

Note: DATP: Days after transplanting

## Effect on cured leaf yield

The bidi tobacco cured leaf yield was affected due to different foliar spray treatments significantly higher yield (4523 kg $ha^{-1}$)was obtained in treatment $T_5$ (RDN *fb* Foliar spray of 2% $KNO_3$ at 45 and 60 DATP). Treatments $T_2$ (RDN *fb* Foliar spray of 2% Urea at 45 and 60 DATP), $T_4$ (RDN *fb* Foliar spray of 2% Urea + Foliar spray of 2% SOP tank mix at 45 and 60 DATP) and $T_3$ (RDN *fb* Foliar spray of 2% SOP at 45 and 60 DATP) were statistically at par with treatment $T_5$. Significantly lower yield (3373 kg $ha^{-1}$) was found in treatment $T_1$ (RDN @180 kg $ha^{-1}$). The foliar application of N and K can greatly enhance the bright grade leaf production and productivity in the rainfed tobacco by Prabhakar *et al.,* (2016). These results are in collaboration with those obtained by Fawzy *et al.,* (2007) in eggplant, Dkhil *et al.,* (2011) in potato, Basha *et al.,* (2019) in tobacco.

## Effect on economics

Treatment $T_5$ (RDN *fb* foliar spray of 2% $KNO_3$at 45 and 60 DATP) recorded maximum net returns of (Rs. 154535 $ha^{-1}$) and next in line net returns (Rs. 146609 $ha^{-1}$) was found in treatment $T_2$ (RDN *fb* foliar spray of 2% Urea at 45 and 60 DATP) and lower net returns (Rs. 105901 $ha^{-1}$) was obtained from treatment $T_9$.

The maximum value of BCR (3.64) was obtained from treatment $T_5$ (RDN *fb* foliar spray of 2% $KNO_3$ at 45 and 60 DATP). The next was found (3.60) in treatment $T_2$ (RDN *fb* foliar spray of 2% Urea at 45 and 60 DATP) and lower BCR (2.97) was obtained from treatment $T_9$.

It can be concluded from the present investigation that higher cured leaf yield of bidi tobacco, net realization and benefit cost ratio (BCR) could be achieved through soil application of 180 kg N $ha^{-1}$ (RDN) with two time (45 and 60 DATP) foliar spray of either 2% potassium nitrate ($KNO_3$) or 2% Urea or 2% Urea + 2% sulphate of potash (SOP) or 2% SOP.

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