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Production potential of *kharif* based cropping system for *bidi* tobacco (*Nicotiana tabacum* L.) in central Gujarat

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Abstract

A field experiment was conducted for three years during 2017-18 to 2019-20 at Bidi Tobacco Research Station, Anand Agricultural University, Anand to assess the possibility of harvesting an early *kharif* crop before planting of *bidi* tobacco in central Gujarat region with the objective of increasing economic returns from same piece of land in a year. The experiment was laid out in a randomized block design with four replications. The treatments comprised of six cropping sequences. The pooled over three year results revealed that vegetable cowpea - tobacco recorded significantly higher values of tobacco leaf equivalent yield (5763 kg/ha), gross returns (244102 ₹/ha) as well as net profit (170848 ₹/ha) over rest of cropping sequences except, fodder sorghum - tobacco. Significantly lower tobacco leaf equivalent yield (4496 kg/ha) as well as net profit (117727 ₹/ha) were recorded in vegetable clusterbean - tobacco followed by greengram - tobacco, blackgram - tobacco and sesamum - tobacco cropping sequences.

Keywords: pulse crop, *bidi* tobacco, cropping system, tobacco leaf equivalent yield, economics

Introduction

Tobacco (*Nicotiana tabacum* L.) is an important commercial crop grown in Gujarat up to 1.58 million hectares. The average annual production is 295 million kg with a productivity of 1858 kg/ha. (Anonymous, 2020). *Bidi* tobacco occupies 46 % and 50% of total area and production, respectively in the Anand region of central Gujarat (Patel, 2018). Due to the well distributed rainfall throughout the growing season, monoculture of *bidi* tobacco is in vogue either with sunnhemp as green manure or kept fallow with intermittent harrowing before planting tobacco. However, many farmers prepare their land by the second week of June and fallow it till planting tobacco during third week of August to third week of September. Hence, there is a scope for late summer and early *kharif* crops prior to *bidi* tobacco. Gujarat lacks information on these aspects, prompted us to undertake the study to find out a suitable crop that can be grown before planting *bidi* tobacco for better resource utilization and obtaining more revenue from same piece of land in a year.

Materials and Methods

A field experiment entitled "Production potential of *kharif* based cropping system for *bidi* tobacco (*Nicotiana tabacum* L.) in central Gujarat" was undertaken in *kharif* - *rabi* season during 2017-18 to 2019-20 at Bidi Tobacco Research Station, Anand Agricultural University, Anand. The treatments included six cropping sequences, viz. fodder sorghum - tobacco, greengram - tobacco, blackgram - tobacco, sesamum - tobacco, vegetable cowpea - tobacco and vegetable clusterbean - tobacco. The experiment was laid out in a randomized block design with four replications. The soil type of experiment was loamy sand in texture and slightly alkaline in reaction. Total annual rainfall of 726.8, 937.2 and 1305 mm were recorded for years 2017-18, 2018-19 and 2019-20, respectively compared to the region's normal rainfall of 862 mm. *Kharif* crops were sown by first week of June with spacing 45 x 15 cm and recommended fertilizers were applied at the time of sowing except fodder sorghum, seeds were broadcasted. Tested cultivars were S-1049, GAM 5, T 9, Gujarat till 3, AVC 1, Pusa Navbahar and GABT 11 for fodder sorghum, greengram, blackgram, sesamum, vegetable cowpea, vegetable clusterbean and *bidi* tobacco, respectively. After harvesting the preceding *kharif* crops according to the treatments, 45 days old *bidi* tobacco seedlings were transplanted during the third week of September and followed the recommended package of practices. Data on yield and yield components were gathered and statistically examined.

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The prevailing market prices of the crops (Table 1) were used to convert the economic yields of the component crops to

TLEY. (Bhargavi *et al.*, 2019) [2].

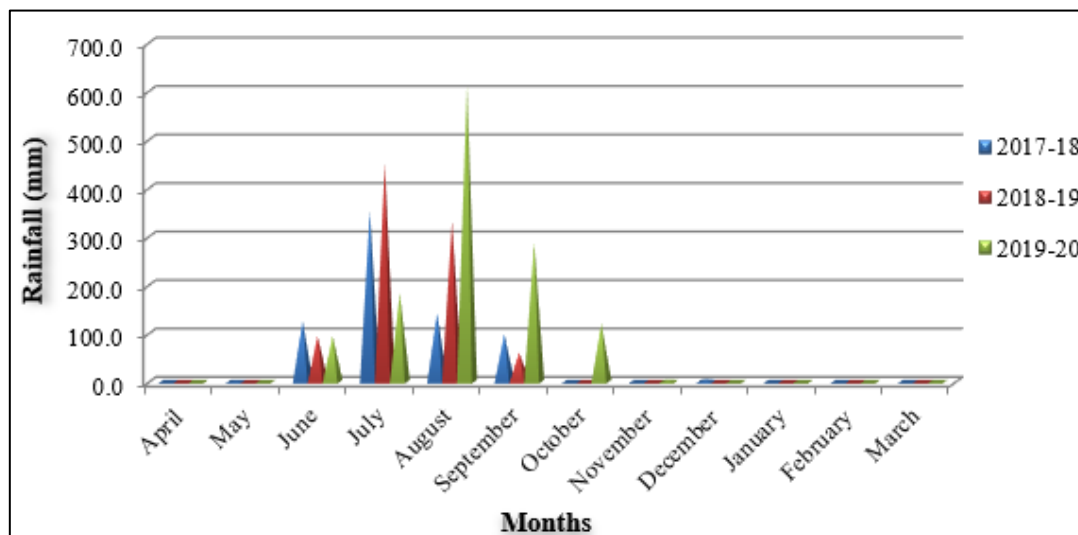


Fig 1: Rainfall pattern of experimental area during study period

Table 1: Prevailing market price (₹/kg)

| Crop | 2017-18 | 2018-19 | 2019-20 | Average |
|-----------------------|---------|---------|---------|---------|
| Fodder sorghum | 01 | 01 | 01 | 1.00 |
| Greengram | 50 | 40 | 20 | 36.67 |
| Blackgram | 50 | 40 | 25 | 38.33 |
| Sesamum | 00 | 00 | 00 | 0.00 |
| Vegetable cowpea | 12 | 12 | 12 | 12.00 |
| Vegetable clusterbean | 12 | 12 | 15 | 13.00 |
| Bidi tobacco | 40 | 40 | 47.12 | 42.37 |

Results and Discussion

Tobacco yield parameters

Tobacco leaf length, width and thickness as well as plant height were determined to be non-significant due to the different *kharif* based cropping systems in a pooled three year data set (Table 2). However, taller plant with maximum leaf length and width of tobacco were observed in sesamum-tobacco system. It could be as a result of incorporation of sesamum plant residues in the soil before tobacco planting. Similar results were reported by Gediya *et al.* (2020) [3], Karkanis *et al.* (2007) [4] and Naik *et al.* (2004) [8] that sunnhemp green manuring prior to *bidi* tobacco planting gave maximum tobacco leaf length, width and plant height.

Yield of *kharif* crops and *bidi* tobacco

Yield of *kharif* crops and *bidi* tobacco were illustrated in Table 3. The yields of various *kharif* crops grown prior to tobacco were relatively lower as compared to their potential yield. The reduction in the yields of *kharif* crops may be attributed to heavy rainfall during their flowering and pod development stages during the months of July and August in all three years shown in Fig 1. Because of the heavy rain, more vegetative growth was observed, which resulted in failure of pod formation and development, particularly in sesamum. As a result, during the study periods (Years 2017-18, 2018-19 and 2019-20), no sesamum yield was obtained

and sesamum vegetative residues were incorporated into the soil as green manuring in respected experimental plots before tobacco planting. Different *kharif* based cropping systems were failed to exert their significant effect on tobacco yield. However, among these cropping systems, sesamum- tobacco gave maximum tobacco yield. It might be due to maximum tobacco leaf size and plant height.

Tobacco Leaf Equivalent Yield (TLEY)

During 2017-18 and 2018-19, vegetable cowpea - tobacco cropping system recorded significantly higher TLEY of 5434 and 6121 kg/ha, respectively. They were remained at par with fodder sorghum - tobacco and greengram - tobacco during both the years (Table 4). Whereas, significantly lower TLEY was recorded with blackgram - tobacco, vegetable clusterbean - tobacco and sesamum - tobacco. However, all these systems were at par with each other and also comparable with rest of cropping systems. Pragathi Kumari *et al.* (2019) [10], Mohapatra *et al.* (2017) [6] and Munirathnam and Jaffar Basha (2010) reported that sesamum as a preceding crop of tobacco as well as rice was found not economical as it gained lowest TLEY and RGEY, respectively. During 2019-20, there is no any significant difference found in TLEY. In pooled results, similar trend was observed for TLEY as shown during 2017-18 and 2018-19 that vegetable cowpea - tobacco recorded significantly higher TLEY of 5763 kg/ha followed by fodder sorghum - tobacco. The results are in agreement with the findings of Munirathnam and Jaffar Basha (2010) [7], Sadhu *et al.* (2002) [11] and Tomar and Tiwari (1990) [12] who have reported that inclusion of vegetable crops in tobacco based cropping system, increased TLEY due to their higher market price. Whereas, vegetable clusterbean - tobacco gave significantly lower TLEY of 4496 kg/ha due to lower yield of clusterbean and tobacco. It was remained at par with blackgram - tobacco, sesamum - tobacco and greengram - tobacco systems.

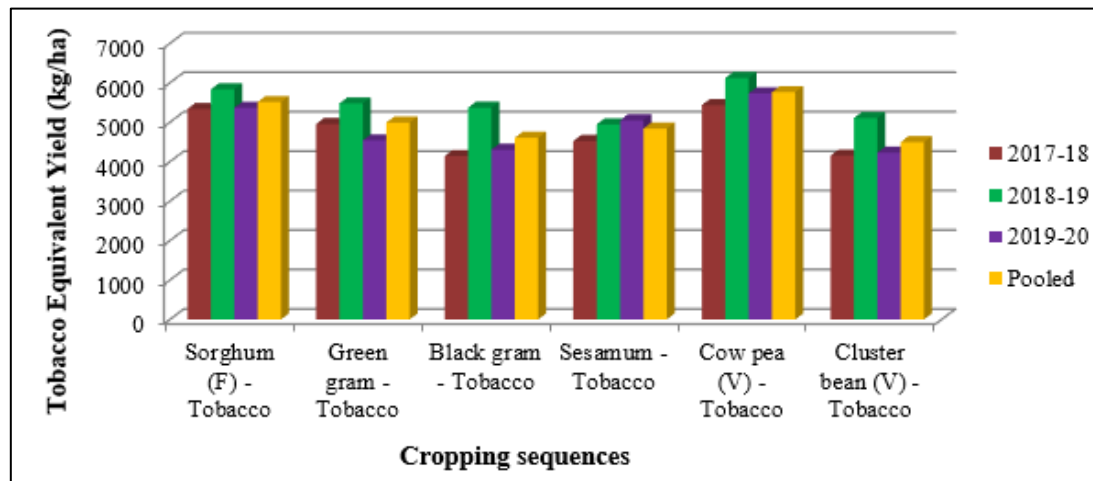


Fig 2: TLEY of different cropping sequences during study period

Economics

Maximum gross and net incomes of ₹ 244102/ha and ₹ 170848/ha, respectively were observed in vegetable cowpea - tobacco with BCR value 3.33. Next best *kharif* based cropping system was fodder sorghum - tobacco with net

income ₹ 159177/ha and BCR 3.15. Similar finding was reported by Kiran Kumar *et al.* (2019). Whereas, minimum gross income of ₹ 189896/ha as well as net income ₹ 117727/ha were recorded in clusterbean - tobacco with BCR value 2.63 (Table 5).

Table 2: Tobacco yield parameters as affected by different treatments (Pooled over 2017-18 to 2019-20)

| Treatments | Leaf length (cm) | Leaf width (cm) | Leaf thickness (mg/cm ²) | Plant height (cm) |
|----------------------------|------------------|-----------------|--------------------------------------|-------------------|
| Sorghum (F) - Tobacco | 54.16 | 26.44 | 8.67 | 83.54 |
| Green gram - Tobacco | 54.12 | 23.92 | 8.96 | 81.05 |
| Black gram - Tobacco | 55.89 | 24.61 | 8.91 | 81.67 |
| Sesamum - Tobacco | 58.01 | 26.85 | 8.07 | 87.74 |
| Cow pea (V) - Tobacco | 56.77 | 25.05 | 9.88 | 84.68 |
| Cluster bean (V) - Tobacco | 57.10 | 25.75 | 8.66 | 84.70 |
| S. Em. ± | 1.05 | 1.12 | 0.56 | 2.06 |
| C. D. at 5% | NS | NS | NS | NS |
| C. V. % | 6.50 | 15.30 | 12.60 | 8.50 |

Table 3: Yield of *kharif* crops and *bidi* tobacco as affected by different treatments

| Treatments | <i>Kharif</i> crop yield (kg/ha) | | | | Tobacco yield (kg/ha) | | | |
|----------------------------|----------------------------------|---------|---------|--------|-----------------------|---------|---------|--------|
| | 2017-18 | 2018-19 | 2019-20 | Pooled | 2017-18 | 2018-19 | 2019-20 | Pooled |
| Sorghum (F) - Tobacco | 48148 | 44939 | 34744 | 42610 | 4136 | 4712 | 4628 | 4492 |
| Green gram - Tobacco | 793 | 590 | 315 | 566 | 3965 | 4888 | 4407 | 4420 |
| Black gram - Tobacco | 353 | 275 | 421 | 349 | 3704 | 5095 | 4083 | 4294 |
| Sesamum - Tobacco | 0 | 0 | 0 | 0 | 4525 | 4946 | 5050 | 4840 |
| Cow pea (V) - Tobacco | 4422 | 3414 | 4274 | 4037 | 4108 | 5097 | 4644 | 4616 |
| Cluster bean (V) - Tobacco | 963 | 728 | 300 | 663 | 3866 | 4887 | 4134 | 4296 |
| S. Em. ± | -- | -- | -- | -- | 232 | 266 | 416 | 182 |
| C. D. at 5% | -- | -- | -- | -- | NS | NS | NS | NS |
| C. V. % | -- | -- | -- | -- | 12 | 11 | 19 | 14 |

Table 4: Tobacco Leaf Equivalent Yield (TLEY) as affected by different treatments

| Treatments | TLEY (kg/ha) | | | |
|----------------------------|--------------|---------|---------|--------|
| | 2017-18 | 2018-19 | 2019-20 | Pooled |
| Sorghum (F) - Tobacco | 5339 | 5835 | 5366 | 5513 |
| Green gram - Tobacco | 4956 | 5477 | 4540 | 4991 |
| Black gram - Tobacco | 4144 | 5370 | 4306 | 4607 |
| Sesamum - Tobacco | 4525 | 4946 | 5050 | 4840 |
| Cow pea (V) - Tobacco | 5434 | 6121 | 5733 | 5763 |
| Cluster bean (V) - Tobacco | 4155 | 5105 | 4229 | 4496 |
| S. Em. ± | 259.3 | 256.1 | 409.0 | 182.6 |
| C. D. at 5% | 781.6 | 771.8 | NS | 520.1 |
| C. V. % | 10.9 | 9.4 | 16.8 | 12.6 |

Table 5: Economics of different treatments (Pooled over 2017-18 to 2019-20)

| Crop | Gross income (₹/ha) | Cost of cultivation (₹/ha) | Net income (₹/ha) | BCR |
|----------------------------|---------------------|----------------------------|-------------------|------|
| Sorghum (F) - Tobacco | 233268 | 74091 | 159177 | 3.15 |
| Green gram - Tobacco | 210417 | 73597 | 136820 | 2.86 |
| Black gram - Tobacco | 194494 | 74063 | 120431 | 2.63 |
| Sesamum - Tobacco | 205593 | 67254 | 138339 | 3.06 |
| Cow pea (V) - Tobacco | 244102 | 73253 | 170848 | 3.33 |
| Cluster bean (V) - Tobacco | 189896 | 72169 | 117727 | 2.63 |

**Overview of the experiment (Kharif crops - Tobacco)****T₅: Vegetable Cowpea - Tobacco**

Conclusion

It can be concluded that, rather than leaving the land fallow during the *kharif*, sowing vegetable cowpea as a preceding crop to *bidi* tobacco would be more remunerative and profitable, providing the farmer with additional income from the same piece of land.

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