

## INVESTIGATION ON ECONOMICALLY VIABLE ALTERNATIVE CROPPING SYSTEMS FOR *BIDI* TOBACCO IN MIDDLE GUJARAT CONDITIONS

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### **ABSTRACT**

*A field experiment was conducted to evaluate viable alternative cropping systems for bidi tobacco (Nicotiana tabacum L.) in middle Gujarat condition for the three years (2012-13 to 2013-14 and 2015-16) at Bidi Tobacco Research Station, Anand Agricultural University, Anand. Sole crop of bidi tobacco was compared with different cropping sequences i.e. tobacco followed by summer pearl millet, cotton followed by summer pearl millet, castor followed by summer pearl millet, pigeon pea followed by summer pearl millet, maize - mustard – summer pearl millet, pearl millet - wheat – summer pearl millet and maize - wheat – summer pearl millet cropping sequence in Randomized Block Design. The studies on cropping sequences in bidi tobacco areas indicated that tobacco-pearl millet (summer) cropping sequence performed better with respect to higher tobacco equivalent yield (3940 kg/ha) and economically viable alternate to bidi tobacco (Net income 124706 Rs./ha) followed by sole crop of bidi tobacco.*

**Keywords :** *alternative crop sequences, bidi tobacco, yield and economics*

### **INTRODUCTION**

Tobacco is one of the most economically significant agricultural crops in the world. In the global scenario, Indian tobacco accounts for 10% of the area and 9% of the total production. India is the 2<sup>nd</sup> largest producer of tobacco grown in 0.45 M ha (0.27% of the net cultivated area) with approx. 750 M kg of tobacco leaf production. Tobacco is an important commercial crop in India, generating enormous socio-economic benefits in terms of agricultural employment, farm incomes, revenue generation and foreign exchange earnings. Tobacco occupies a mere 0.24% of the country's total arable land area. It is grown largely in semi-arid and rain-fed areas. Tobacco industry provides livelihood to 45.7 million people including farmers, farm labour, rural poor, women, tribal etc. (Anonymous, 2017<sub>a</sub> and Anonymous, 2017<sub>b</sub>). In India tobacco is predominantly cultivated in AP, Gujarat, Karnataka, UP and Bihar. Gujarat accounts for 45 per cent of the area (0.13 M ha) and 30 per cent of production (0.16 M T). Productivity is also the highest (1700 kg/ha) in Gujarat followed by AP (Anonymous, 2016).

India being a signatory to Framework Convention on Tobacco Control (FCTC) under World Health Organization (WHO) is under obligation to reduce tobacco production to 50% of the present level by 2020. In the light of the growing

concerns about the health hazards of tobacco, it is necessary for the tobacco growers and the researchers to look for alternative crops and cropping systems, which are equally remunerative (Kasturi-Krishna *et.al*, 2010). The limited intervention studies indicate that tobacco is not the only crop that can bring good returns. Sugar-cane, onion, maize and other vegetables under irrigated conditions and groundnut and soybean under rain-fed conditions, could be possible alternatives to tobacco. It was observed that mixed non-tobacco cropping patterns may perhaps be a good substitute strategy for tobacco cultivation (Prasad, V. M., 2007). Keeping in view, present investigation has been planned.

### **OBJECTIVE**

To know the economically investigation on economically viable alternative cropping systems for bidi tobacco (*Nicotiana tabacum L.*) in middle gujarat conditions.

### **METHODOLOGY**

A field experiment was conducted for three years (2012-13, 2013-14 and 2015-16) during all three seasons at Bidi Tobacco Research Station, Anand Agricultural University, Anand. The soil of the experiment was sandy loam. The experiment was laid out in a randomized block design replicated four times. Total eight treatments consisted

of tobacco as sole crop, tobacco followed by pearl millet, cotton followed by summer pearl millet, castor followed by summer pearl millet, pigeon pea followed by summer pearl millet, maize - mustard – summer pearl millet cropping sequence, pearl millet - wheat - summer pearl millet cropping sequence and maize - wheat – summer pearl millet cropping sequence.

**Table 1 : Cultural practices followed for *kharif*, *rabi* and summer crops**

Sr. No.	Crop	Variety	Spacing (cm)	Fertilizer (kg/ha) N – P, O <sub>5</sub> – K, O	Season
1	Tobacco	MRGTH 1	90 x 60	220 - 0 - 0	<i>Kharif</i>
2	Cotton	Bt cotton	90 x 60	240 - 0 - 0	<i>Kharif</i>
3	Maize	GM 6	60 x 20	100 - 50 - 0	<i>Kharif</i>
4	Castor	GCH 7	90 x 60	75 - 50 - 0	<i>Kharif</i>
5	Pigeon pea	GT 100	90 x 30	25 - 50 - 0	<i>Kharif</i>
6	Pearl millet	GHB 558	45 x 10	80 - 40 - 0	<i>Kharif, Summer</i>
7	Mustard	GM 1	45 x 10	50 - 50 - 0	<i>Rabi</i>
8	Wheat	GW 496	22.5 x 10	120 - 60 - 0	<i>Rabi</i>

Seeds of *kharif* crops *i.e.* cotton, maize, pigeon pea and pearl millet were direct sown during the last week of June whereas castor seeds and tobacco seedlings were planted during the 3<sup>rd</sup> week of August. *Kharif* maize and pearl millet were harvested in the 2<sup>nd</sup> week of October except that all *kharif* crops *i.e.* cotton, castor, pigeon pea and tobacco harvesting were done up to 1<sup>st</sup> week of January. After harvesting of *kharif* maize and pearl millet crops, *rabi* crops mustard and wheat were sown during 2<sup>nd</sup> fortnight of November and as per treatments remaining plots were kept fallow. In summer, pearl millet crop was taken in all treatments only one is left

**Formula to calculate Tobacco Equivalent Yield=**

$$\frac{\text{Yield of crop other than tobacco (kg/ha)} \times \text{Price of other crop (₹/kg)}}{\text{Price of tobacco crop (₹/kg)}}$$

## RESULTS AND DISCUSSION

Tobacco equivalent yield of tobacco was observed maximum in the year 2015-16 compared to the year 2012-13 and 2013-14. (Table 2 & 3). It was found maximum due to fairly good distribution of rains during the cropping season. During the year 2013-14, different crop yields were noticed very low because of improper distribution and more than normal rains especially during grand growth phase of the

that is tobacco as a sole treatment.

The yield of each crop harvested was converted into per hectare basis and also to that of tobacco equivalent yield. For all the three years, economics was carried out. The annual rainfall of 882.7, 1391.6 and 508.4 mm were recorded respectively for 2012-13 2013-14 and 2015-16 as against the normal rainfall of 862 mm. The tobacco equivalent yield data was subjected to statistical analysis at five per cent level of significance to interpret the treatment differences.

crops.

According to pooled data of all three years, treatment T<sub>2</sub> (Tobacco followed by summer Pearl millet cropping sequence) recorded significantly higher tobacco equivalent yield and net return in the year 2015-16. Whereas, minimum tobacco equivalent yield was observed in treatment T<sub>3</sub> (Cotton followed by summer Pearl millet cropping sequence).

Extension Strategies for Doubling the Farmers' Income for Livelyhood Security

Table 2 : Different crop yields and economics [2012-13]

Trt	Crop	Yield (kg/ha)				Economics (₹/ha)			
		Kharif	Rabi	Summer	Tobacco equivalent yield	Total Income	Total Cost	Net Profit	BCR
T <sub>1</sub>	Tobacco ( <i>Kharif-Rabi</i> ) alone	2772	0	0	2772	119185	42960	76226	2.8
T <sub>2</sub>	Tobacco ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	2771	0	1761	3356	144293	60615	83678	2.4
T <sub>3</sub>	Cotton ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	2023	0	1811	2479	106595	52556	54039	2.0
T <sub>4</sub>	Castor ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	1823	0	1805	1863	80115	45069	35046	1.8
T <sub>5</sub>	Pigeon pea ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	1468	0	1889	1807	77680	43028	34653	1.8
T <sub>6</sub>	Maize ( <i>Kharif</i> ) – Mustard ( <i>Rabi</i> ) – Pearl millet (Summer)	2302	1363	1734	2475	106412	55367	51045	1.9
T <sub>7</sub>	Pearl millet ( <i>Kharif</i> ) – Wheat ( <i>Rabi</i> ) – Pearl millet (Summer)	2041	3024	1813	2487	106923	68200	38723	1.6
T <sub>8</sub>	Maize ( <i>Kharif</i> ) – Wheat ( <i>Rabi</i> ) – Pearl millet (Summer)	2234	3016	1832	2729	117353	69501	47852	1.7
S. Em. ±		–	–	–	98	–	–	–	–
C. D. at 5%		–	–	–	289	–	–	–	–
C. V. %		–	–	–	08	–	–	–	–

Selling price (₹/kg): Tobacco: 43.0, Cotton: 40.0, Pearl millet (*Kharif* & Summer): 12.20, Castor: 30.0, Pigeon pea:35.0, Maize:15.0, Mustard:30.0, Wheat: 17.10

Table 3 : Different crop yields and economics [2013-14]

Trt	Crop	Yield (kg/ha)				Economics (₹/ha)			
		Kharif	Rabi	Summer	Tobacco equivalent yield	Total Income	Total Cost	Net Profit	BCR
T <sub>1</sub>	Tobacco ( <i>Kharif-Rabi</i> ) alone	2754	0	1598	2754	179561	42960	136602	4.2
T <sub>2</sub>	Tobacco ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	2769	0	1598	3131	204156	60912	143244	3.4
T <sub>3</sub>	Cotton ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	1885	0	1630	1871	121989	52989	69000	2.3
T <sub>4</sub>	Castor ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	1789	0	1809	1332	86856	45402	41454	1.9
T <sub>5</sub>	Pigeon pea ( <i>Kharif-Rabi</i> ) – Pearl millet (summer)	1423	0	1897	1069	69667	43544	26123	1.6
T <sub>6</sub>	Maize ( <i>Kharif</i> ) – Mustard ( <i>Rabi</i> ) – Pearl millet (Summer)	2018	2033	1570	1819	118587	56064	62523	2.1

<b>T7</b>	Pearl millet ( <i>Kharif</i> ) – Wheat ( <i>Rabi</i> ) – Pearl millet (Summer)	1765	2184	1606	1267	82605	69428	13177	1.2
<b>T8</b>	Maize ( <i>Kharif</i> ) – Wheat ( <i>Rabi</i> ) – Pearl millet (Summer)	1980	1214	1609	1166	76043	70541	5502	1.1
S. Em. $\pm$		–	–	–	65	–	–	–	–
C. D. at 5%		–	–	–	<b>192</b>	–	–	–	–
C. V. %		–	–	–	07	–	–	–	–

**Selling price (₹/kg):** Tobacco: 65.20, Cotton: 52.0, Pearl millet (*Kharif* & Summer): 12.50, Castor: 34.0, Pigeon pea:30.0, Maize:14.0, Mustard:28.0, Wheat: 15.0

**Table 4 : Different crop yields and economics [2015-16]**

Trt	Crop	Yield (kg/ha)				Economics (₹/ha)			
		<i>Kharif</i>	<i>Rabi</i>	Summer	Tobacco equivalent yield	Total Income	Total Cost	Net Profit	BCR
<b>T<sub>1</sub></b>	Tobacco ( <i>Kharif-Rabi</i> ) alone	4255	0	0	4255	172380	38057	134323	4.5
<b>T<sub>2</sub></b>	Tobacco ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	3945	0	3167	5334	216079	68883	147196	3.1
<b>T<sub>3</sub></b>	Cotton ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	2134	0	3392	2538	102822	68447	34375	1.5
<b>T<sub>4</sub></b>	Castor ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	3297	0	3633	3829	155112	69267	85845	2.2
<b>T<sub>5</sub></b>	Pigeon pea ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	3437	0	3247	3965	160608	80130	80478	2.0
<b>T<sub>6</sub></b>	Maize ( <i>Kharif</i> ) - Mustard ( <i>Rabi</i> ) - Pearl millet (Summer)	3789	1881	3360	4394	177990	68787	109203	2.6
<b>T7</b>	Pearl millet ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	3201	4304	3247	3863	156505	88981	67524	1.8
<b>T8</b>	Maize ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	3344	3974	3119	3747	151777	106894	44883	1.4
S. Em. $\pm$		---	---	---	239	---	---	---	---
C. D. at 5%		---	---	---	<b>704</b>	---	---	---	---
C. V. %		---	---	---	12	---	---	---	---

**Selling price (₹/kg):** Tobacco: 40.51, Cotton: 20.0, Pearl millet: 12.50 (Kh) & 15.70 (Summer), Castor: 27.50, Pigeon pea:30.0, Maize:12.50, Mustard:35.0, Wheat: 12.50

**Table 5: Tobacco equivalent yield (Pooled)**

Trt	Crop	Tobacco equivalent yield (kg/ha)			
		2012-13	2013-14	2015-16	Pooled
T <sub>1</sub>	Tobacco ( <i>Kharif-Rabi</i> ) alone	2772	2754	4255	3260
T <sub>2</sub>	Tobacco ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	3356	3131	5334	3940
T <sub>3</sub>	Cotton ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	2479	1871	2538	2296
T <sub>4</sub>	Castor ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	1863	1332	3829	2341
T <sub>5</sub>	Pigeon pea ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	1807	1069	3965	2280
T <sub>6</sub>	Maize ( <i>Kharif</i> ) - Mustard ( <i>Rabi</i> ) - Pearl millet (Summer)	2475	1819	4394	2896
T <sub>7</sub>	Pearl millet ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	2487	1267	3863	2539
T <sub>8</sub>	Maize ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	2729	1166	3747	2547
S. Em. ±		98	65	239	267
C. D. at 5%		<b>289</b>	<b>192</b>	<b>704</b>	<b>810</b>
C. V. %		8	7	12	11
Year Effect		---	---	---	154
Year x Trt. Effect		---	---	---	436

**Table 6 : Tobacco equivalent yield and economics (Pooled)**

Treatment		Tobacco equivalent yield (kg/ha)	Gross income (₹/kg)	Total cost (₹/kg)	Net income (₹/kg)	BCR
T <sub>1</sub>	Tobacco ( <i>Kharif-Rabi</i> ) alone	<b>3260</b>	157042	41325	115717	3.80
T <sub>2</sub>	Tobacco ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	3940	188176	63470	124706	2.96
T <sub>3</sub>	Cotton ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	2296	110469	57998	52471	1.90
T <sub>4</sub>	Castor ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	2341	107361	53246	54115	2.02
T <sub>5</sub>	Pigeon pea ( <i>Kharif-Rabi</i> ) - Pearl millet (summer)	2280	102652	55567	47085	1.85
T <sub>6</sub>	Maize ( <i>Kharif</i> ) - Mustard ( <i>Rabi</i> ) - Pearl millet (Summer)	2896	134329	60073	74257	2.24
T <sub>7</sub>	Pearl millet ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	2539	115344	75537	39808	1.53
T <sub>8</sub>	Maize ( <i>Kharif</i> ) - Wheat ( <i>Rabi</i> ) - Pearl millet (Summer)	2547	115057	82312	32746	1.40
S. Em. ±		267	-	-	-	-
C. D. at 5%		<b>810</b>	-	-	-	-
C. V. %		11	-	-	-	-
Year Effect		154	-	-	-	-
Year x Trt. Effect		436	-	-	-	-

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