Indian Journal of Agronomy 47 (2) : 191–195 (June 2002)

Production potential and economics of different crop sequences under irrigated conditions of Gujarat

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Received: September 2001

ABSTRACT

A field experiment was conducted during the rainy and summer seasons of 1995–96 to 1998–99 at Anand, to study the productivity and economics of different cropping sequences. Cropping systems involving vegetables gave higher rainy-season crop-equivalent yield and net return than others. Summer okra (*Abelmoschus esculentus* L.) for vegetable grown in sequence resulted in higher yields of rainy crops, while pigeonpea [*Cajuns cajan* (L.) Millsp.] had beneficial effects on succeeding summer crops. Among the crop sequences tried, brinjal (*Solanum melongena* L.)–okra was the most remunerative rainy-season summer cropping system and gave maximum net returns (Rs 58, 570/ ha) as well as the highest benefit : cost ratio (1.94). The other remunerative cropping systems were brinjal–cowpea [*Vigna unguiculata* (L.) Walp.], fennel (*Foeniculum vulgare* L.)–cowpea and fennel–okra in that order.

Key words : Production potential, Economics, Rainy season-summer crop sequences

There is a wide scope of multiple cropping in middle Gujarat region owing to ample source of canal irrigation facilities even in summer season. The cropping pattern in this region is changing and vegetable crops are becoming popular in recent years. Though vegetables are important constituents of the daily diet in India, their per caput availability is estimated at 135 g/day, against the minimum requirement of 285 g/day (Hosmani *et al.*, 2000). Being short-duration crops, vegetables fit well in multiple cropping systems and give higher tonnage compared to cereals. Tobacco, cotton, pigenopea and pearlmillet are the most important crops of Gujarat Agro-climatic Zone XIII. Although tobacco-pearlmillet is the most profitable sequence presently being followed in middle Gujarat, the productivity and return can be improved by including the highly remunerative vegetable crops in the

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sequence. Hence this investigation was carried out to study the suitability of growing vegetable and legume crops in sequence with major crops of this region.

MATERIALS AND METHODS

The field experiment was conducted during 1995–96 to 1998–99 at B.A. College of Agriculture, Anand, on sandy-loam soil under irrigated condition. The soil was low in organic carbon (0.29 %) and available nitrogen (218.0 kg/ha), high in available phosphorus (59.5kg/ha) and medium in potassium (384.3 kg/ha), with pH 7.8. The experiment was laid out in strip plot design with 3 replications, keeping the layout undisturbed throughout the course of investigation. Twenty-five treatments of different crop sequences consisted of 5 rainy-season crops (fennel, brinjal for vegetable, cotton, pigeonpea and tobacco) and 5 summer crops (pearlmillet, okra for vegetable, cowpea for vegetable, green-gram and groundnut). The rainy-season crops were followed by summer crops in each sequence. The plot size was 6.0 m × 5.4 m. All the packages of practices were followed for raising of crops.

The economics of different crop sequences were worked out with the cost of cultivation at current prices at the end of experiment and gross realization and net returns at prevailing market prices of the produce. For comparison between crop sequences, the gross realization was worked out and yields of all summer crops were converted into rainy-season crop-equivalent yield on price basis (Yadav and Newaj, 1990)

RESULTS AND DISCUSSION

Rainy-season crop yield

Economic yields of the rainy-season crops were affected by different crop sequences (Table 1). Fennel gave the highest grain yields during 1995, 1997 and in average production, while brinjal gave the maximum vegetable yields during 1996, 1997, 1998 and in average of 4 years when both the crops were grown in sequence with okra (V). Likewise, tobacco during 1996 and in mean basis and cotton in all the years as well as on an average gave the maximum yields of tobacco leaf and seed cotton, respectively, when rotated with okra (V). However, pigeonpea registered the highest grain yield in sequence with pearl-millet except during 1996. Higher yields of rainy-season crops in a sequence with okra may be owing to lower vegetative growth of okra grown in summer for vegetable purpose.

Summer crop yield

In summer season, pearlmillet gave the highest seed yield in sequence with cotton and okra recorded the highest vegetable yield in sequence with pigeonpea during 1996, 1998 and in average of 4 years (Table 1). Cowpea gave the maximum vegetable yield during individual years and on an average after pigeonpea, while greengram registered the highest grain yield during 1998, 1999 and in average of 4 years, when grown after pigeonpea. However, groundnut gave the maximum pod yield in sequence with tobacco.

Summer crops pearlmillet, cowpea (V), greengram and groundnut recorded the

Table 1. Economic yield of rainy season and summer crops as influenced by different crop sequences

Crop sequences	Rainy season crop yield (kg/ha)					Yield of main produce of summer crop (kg/ha)					Fodder yield of summer crop (kg/ha)				
	1995	1996	1997	1998	Mean	1996	1997	1998	1999	Mean	1996	1997	1998	1999	Mean
Fennel–pearlmillet	1,909	1,545	1,157	1,437	1,512	2,527	2,952	1,948	2,585	2,503	7,523	6,743	5,459	5,314	6,260
Fennel–okra (V)*	2,043	1,505	1,263	1,379	1,548	4,525	4,115	1,239	2,498	3,094	-	-	-	-	-
Fennel–cowpea (V)	2,014	1,360	1,090	1,551	1,504	3,663	5,671	3,356	4,327	4,254	2,390	3,258	2,604	4,533	3,196
Fennel–greengram	1,794	1,476	1,177	1,177	1,406	578	654	474	704	603	2,060	1,927	887	2,276	1,788
Fennel–groundnut	1,898	1,447	1,128	1,524	1,499	887	926	627	887	832	2,315	3,419	5,050	5,787	4,143
Brinjal (V) – pearlmillet	27,575	21,342	20,515	20,177	22,402	3,163	2,836	2,382	3,549	2,983	7,523	6,713	5,363	6,501	6,533
Brinjal (V) – okra (V)	28,738	22,222	20,978	20,505	23,111	5,828	5,122	1,582	2,965	3,874	-	-	-	-	-
Brinjal (V) – cowpea (V)	28,373	18,142	20,370	19,107	21,498	3,472	5,833	3,310	5,824	4,610	2,546	3,565	2,913	5,285	3,577
Brinjal (V) – greengram	27,314	17,823	19,714	14,053	19,726	538	559	483	858	610	2,141	2,045	878	2,585	1,912
Brinjal (V) – groundnut	29,531	18,055	20,004	14,072	20,416	752	961	733	1,061	877	2,291	2,952	5,066	6,617	4,232
Cotton–pearlmillet	1,337	966	1,225	1,124	1,163	3,973	3,200	2,643	3,115	3,233	7,326	6,944	6,019	5,631	6,480
Cotton–okra (V)	1,343	1,186	1,553	1,157	1,310	6,086	4,954	1,813	2,286	3,785	-	-	-	-	-
Cotton–cowpea (V)	1,238	967	1,140	950	1,074	3,680	6,453	3,405	5,378	4,729	2,339	3,472	3,472	4,861	3,636
Cotton–greengram	1,157	984	1,418	973	1,133	793	579	405	1,022	700	1,985	2,043	1,206	3,029	2,066
Cotton–groundnut	1,233	839	1,302	1,100	1,119	1,003	961	772	868	901	2,546	3,142	5,372	6,350	4,353
Pigeonpea–pearlmillet	1,580	1,273	1,312	1,437	1,401	3,414	3,218	2,604	3,395	3,158	8,680	7,425	5,363	6,454	6,981
Pigeonpea–okra (V)	1,447	1,140	1,148	1,379	1,279	6,412	4,514	2,421	2,959	4,077	-	-	-	-	-
Pigeonpea–cowpea (V)	1,580	1,292	1,100	1,177	1,287	4,224	7,089	4,099	6,337	5,437	2,739	4,647	3,607	6,211	4,301
Pigeonpea–greengram	1,522	1,198	1,051	1,350	1,280	596	579	492	1,321	747	1,968	1,927	1,109	3,569	2,143
Pigeonpea–groundnut	1,389	1,464	1,273	1,215	1,335	1,100	1,076	627	1,090	973	2,465	3,275	7,230	7,581	5,138
Tobacco–pearlmillet	2,564	2,494	3,260	2,585	2,726	3,530	3,472	2,517	3,193	3,178	8,293	7,425	5,903	5,542	6,791
Tobacco–olra (V)	2,523	2,748	3,154	2,498	2,731	5,793	3,877	1,775	2,372	3,454	-	-	-	-	-
Tobacco–cowpea (V)	2,581	2,563	3,019	2,276	2,610	3,854	5,487	3,250	5,883	4,694	2,465	3,565	3,096	5,498	3,656
Tobacco–greengram	2,674	2,523	3,193	2,421	2,703	735	675	447	916	693	2,008	1,852	781	2,739	1,845
Tobacco–groundnut	2,558	2,419	2,826	1,823	2,407	1,100	1,076	772	1,148	1,024	2,623	3,218	5,779	7,967	4,897

V, For vegetable

highest average fodder production grown in sequence with pigeonpea (Table 1). The higher yields may be owing to improvement in soil fertility after growing leguminous pigeonpea crop in rainy season. The beneficial effect of legumes on succeeding crop were reported by Singh and Venkateswarlu (1985) and Sewa Ram *et al.* (2000).

Rainy-season crop-equivalent yield

Rainy-reason crops like fennel, pigeonpea and tobacco, registered the highest respective rainy-season equivalent yields in sequence with cowpea (V), while brinjal (V) and cotton crops recorded the highest respective rainy-season equivalent yields of 35,508 and 2,824 kg/ha respectively (Table 2) in sequence with okra (V). Higher rainy-season crop-equivalent yields of these cropping systems was owing to the inclusion of vegetable crops, which fetched higher price than other summer crops.

Table 2. Rainy-season crop-equivalent yield and economics of different crop sequences (mean data of 1995–96 to 1998–99)

Crop sequences	Rainy-season crop-equivalent yield (kg/ha)	Gross realization (Rs/ha)	Net returns (Rs/ha)	Benefit: cost ratio
Fennel–pearlmillet	2,030	71,068	43,468	1.57
Fennel–okra (V)*	2,255	78,932	49,132	1.65
Fennel–cowpea (V)	2,325	81,360	51,860	1.76
Fennel–greengram	1,802	63,058	38,008	1.52
Fennel–groundnut	2,045	71,584	43,684	1.57
Brinjal (V) – pearlmillet	30,868	77,170	47,170	1.57
Brinjal (V) – okra (V)	35,508	88,770	58,570	1.94
Brinjal (V) – cowpea (V)	33,993	84,982	53,082	1.66
Brinjal (V) – greengram	25,371	63,427	35,977	1.31
Brinjal (V) – groundnut	28,423	71,058	40,758	1.35
Cotton–pearlmillet	2,295	45,898	21,198	0.86
Cotton–okra (V)	2,824	56,480	29,580	1.10
Cotton–cowpea (V)	2,675	53,490	26,990	1.02
Cotton–greengram	1,936	38,726	16,676	0.76
Cotton–groundnut	2,148	42,951	18,051	0.72
Pigeonpea–pearlmillet	2,761	45,556	25,756	1.30
Pigeonpea–okra (V)	3,256	53,720	31,720	1.44
Pigeonpea–cowpea (V)	3,525	58,159	36,629	1.70
Pigeonpea–greengram	2,315	38,203	20,953	1.21
Pigeonpea–groundnut	2,708	44,680	24,580	1.22
Tobacco–pearlmillet	4,130	66,080	40,880	1.62
Tobacco–okra (V)	4,458	71,358	43,928	1.60
Tobacco–cowpea (V)	4,599	73,580	46,480	1.72
Tobacco–greengram	3,685	58,953	36,303	1.60
Tobacco–groundnut	3,865	61,841	36,341	1.43
CD (P=0.05)	–	8,673	5,471	–

V, For vegetable

Economics of crop sequences

Among different crop sequences, brinjal (V)-okra (V) was the most profitable system and gave the highest gross realization as well as net returns, followed by brinjal (V)–cowpea (V), fennel–cowpea (V) and fennel–okra (V) sequences (Table 2). Pigeonpea–greengram and cotton–greengram sequences registered the minimum gross realization and net return respectively. The highest benefit : cost ratio was also obtained from brinjal (V)–okra (V) crop sequence followed by fennel–cowpea (V). Higher net returns in cropping systems with brinjal (V) may be attributed to higher tonnage of this vegetable crop compared with other rainy-reason crops. Raskar *et al.*, (2000) also reported that summer vegetable crops like okra and brinjal were the most remunerative crops grown in sequence with winter sorghum under irrigated conditions, while Mohankumar and Nair (1990) reported that cropping system involving vegetable cowpea was most profitable among tuber-crop based crop sequences. Chaudhary *et al.* (2000) also indicated that cropping systems involving oilseeds and vegetables gave higher total yield and returns.

Thus brinjal (V)–okra (V) was the most remunerative and suitable cropping sequence, followed by brinjal (V)–cowpea (V), fennel–cowpea (V) and fennel–okara (V) crop sequences for middle Gujarat region under irrigated conditions.

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