

INTRODUCTION

It is apparent that the development of high yielding breeds of crops and livestock, and the breeding of strains that possess a broad spectrum of resistance to pests, disease and to diverse soil stress, coupled with good management, had helped to raise the crop and livestock productivity to high levels.

The large-scale cultivation of improved crop varieties together with efforts to maintain good soil fertility and water management helps to increase production through higher yield per hectare. Land is a shrinking resource for agriculture. A rational land use plan is needed to increase agricultural production by achieving higher yields per ha through intercropping, multiple cropping and increasing cropping intensity.

With the increasing pressure of population on agriculture land, it is now increasingly being felt at the international level, that for meeting the food requirements of the increasing population, more land will have to be brought under cultivation. But India is fortunate to have good potential for increasing productivity, as the productivity in our farming system is far behind its actual potential. The country will have to accord high priority to closing the gap between potential and actual yields in farmers' fields by identifying and removing the constraints responsible for the yield gaps.

After independence, our agricultural policies were influenced greatly by the needs of big landlords. As a result, the needs of the large majority of small peasants were neglected. That is why even after 57 years of independence, three-fourth of our agricultural land remains uneconomical. Because of this lacuna in our agricultural policies, small farmers remain below the poverty line, and our country has not prospered agriculturally. More than 80% of Indian farmers own two and half acre or less land. Their share of cultivated land is about a third of the total available agricultural land in the country. Over time, due to high population growth that caused a division of land holdings, and a very slow growth rate of the rural economy, the pressure on land has been steadily increasing and the number of small and marginal farmers has been growing. These farmers can play a leading role in the development of the country by contributing to the nation's capital formation, if their uneconomic holdings are converted into economic ones. However, with the traditional cropping system, small and marginal farmers are finding it difficult to produce adequate food to feed their families. The only way to convert these holdings into profit-making ones is through the intensive use of land through diversification of crops. So, in order to improve the economic and social status of these targeted groups of farming community, an effort was made by Deendayal Research Institute to develop some technologies for the benefit of marginal farm families. In this regard, a 2.5 acre horticulture-based farming system model was formulated and tested at the KVK, farm, Majhgawan, with the objective of providing sustainable food and nutritional security along with sufficient income. After the success of this model at the KVK farm, the model was replicated at farmer's fields for further validation and to help spread it to other neighboring farmers.

How a change in cropping pattern and diversification of farming system turned an uneconomical land holding into an economical holding – A case study

Shri Rajender Singh of village Degarahat in Majhgawan Tehsil has a 9-member family and possesses 2.5 acres of land. A detailed survey of the farm family conducted in year 2000 revealed that the farmer, despite having 2.5 acres of land, and a well – perennial source of water – was not in a position to earn enough to feed his family well. The farmer was quite frustrated and worried about his poor family condition. The causes of low income were found to be under utilization of available resources by the farmer and traditional system of farming. The cropping pattern being adopted by the farmer was fallow – wheat and fallow – gram. He was advised to purchase a diesel pump for irrigation by taking a loan from State Bank of India. He purchased the Diesel pump, and the KVK selected the farmer for validation of its model.

Details of farming situation, crop yield and income. (Before intervention.)

Sr. No.	Year	Soil Type	Area (acre)	Crop	Yield (Kg)	Income (Rs.)
01	2000 - 2001	Sandy loam	1.75	Wheat	2500	11,250.00
			0.70	Gram	500	6,000.00
			0.05	Vegetables	700	2,330.00

	Total		2.50		3,700	19,580.00
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The farmer was getting a 37.0 quintal yield with a gross income of Rs. 19,580.00 by investing Rs. 2,350.00 on purchase of critical inputs (seeds and pesticides). Thus the net income of the farmer was Rs. 17,230.00 only. Whereas, the annual family expenses (food, clothes, education, house maintenance, social functions and miscellaneous) were calculated as Rs. 32,712.00, thus showing a deficit of Rs. 15,482.00 per annum.

Methodology

The intervention period was for the years 2001-02 and 2002-03. For calculating family requirements of foods per annum, the average balanced diet for moderate type of work for men and women, recommended by the National Institute of Nutrition, Hyderabad was considered. The cropping pattern being followed by the farmer was changed. The planning and layout of field was done on the basis of food requirement of family. The area under each crop was allotted on the basis of average productivity of this crop in the region. Crop calendar for the whole year was prepared to enable the farmer to perform various cultural operations timely.

Basic food requirement of a nine-member family. (According to NIN, Hyderabad.)

Sl. No.	Particulars	Per head per day requirement (gm.)	Food requirement/ Annum (kg)	Family requirement + 5% surplus for family guest
01	Cereals	425	1397.00	1467.00
	Rice	200	657.00	690.00
	Wheat flour	225	740.00	777.00
02	Pulses	70	230.00	241.50
03	Oils	35	115.00	120.75
	Vegetables	285	936.00	983.00
04	Leafy	100	328.50	345.00
	Tubers and roots	85	279.00	293.00
	Other vegetables	100	328.50	345.00
05	Milk	214	703.00	738.00

Food requirement of family also includes 5% surplus to meet requirement of family guests.

Total requirement of family (Food requirement of family + 5% surplus for family guest + Seed for next year. Note: Some figures are higher due loss from crop to food grain.)

Sl. No.	Particulars	Family requirement + 5% surplus for family guest (Kg) (a)	Seed for next year sowing (Kg) (b)	Total requirement (Kg) (c)
01	Cereals (Food grains)	1838.54	100.00	1938.54
	Paddy (65% yield when converted to rice)	1061.54	60.00	1121.54
	Wheat	777.00	40.00	817.00
02	Pulses	241.50	23.00	244.50
	Urad	100.00	3.00	103.00
	Gram	141.50	20.00	161.50
03	Oilseeds	365.90	1.10	367.00
	Mustard (33% yield when converted to oil)	365.90	1.10	367.00
04	Vegetables	983.00	-	1108.00
	Leafy	345.00	-	345.00
	Tubers and roots	293.00	125.00.00	418.00
	Other vegetables	345.00	-	345.00
05	Spices	225.00	26.00	251.00
	Chillies	12.00	-	12.00
	Garlic	18.00	25.00	43.00
	Coriander	15.00	1.00	16.00
	Onion	180.00	-	180.00
05	Milk	738.00	-	738.00

Layout and planning of field

Kharif

Paddy (JR-353) – 1.5 acre					
Urad (PU-30)-0.5 acre	Brinjal 0.05acre	Tomato 0.05acre	Okra 0.05acre	Lobia 0.05acre	Spinach + Radish 0.05acre
	Chilli 0.125 acre			Onion - 0.125 acre	

Rabi

Wheat (WH-147) + Mustard (Varuna) – 1.0 acre				Gram (JG-315) - 0.5 acre	
Mustard (Varuna) - 0.5 acre	Tomato 0.05 acre	Pea 0.05 acre	Potato - 0.125 acre		Spinach + Radish 0.025 acre
	Coriander - 0.125 acre			Garlic - 0.125 acre	

Zaid

Fallow/Green manuring – 1.0 acre			Follow/Green manuring - 0.5		
Bottle Gourd - 0.5 acre	Lobia 0.0625 acre	Okra 0.125 acre		Spinach + Radish 0.025 acre	

Results

The intensive cultivation model resulted in substantial increase in yield & income over the traditional system of cropping. This increase in yield & income could be attributed to intensive use of land and diversification of cropping pattern. A total production of 78.04 quintal and 86.21 quintal through an investment of Rs. 9,356.00 and Rs. 6,952.00 was achieved during the year 2001-02 and 2002-03 respectively, which caused gross and net income of Rs. 51,255.50 and Rs. 41,899.50 during the year 2001-02; and gross and net income of Rs. 56,728.76 and Rs. 49,776.76 during the year 2002-03. After excluding all the annual family expenses, a net saving of Rs. 7,699.00 and Rs. 14,153.00 was achieved during the year 2001-02 and 2002-03 respectively. Thus the production and net income of the farm family has increased by 49.21 quintal and net income by Rs. 32,546.76 during the year 2002-03 over the base year.

Table -1 Data showing crop yield and income from 2.5 acre land holding

Crops	Total Family requirement (c)	Production (Kg.)		Gross Income		Surplus production after meeting family requirement (c)		Value of the surplus produce (Rs.)	
		2001-02 (d)	2002-03 (e)	2001-02	2002-03	2001-02 (d-c)	2002-03 (e-c)	2001-02	2002-03
Cereals	1938.5	2,710.0	2,380.0	14830.0	13907.50	771.5	441.5	4318.00	2707.00
Paddy	1121.5	1,430.0	1,250.0	7150.00	6562.50	308.5	128.5	1540.00	672.00
Wheat	817.0	1,280.0	1,130.0	7680.00	7345.00	463.0	313.0	2778.00	2035.0
Pulses	244.5	465.0	478.0	5675.00	6066.00	220.5	233.5	2353.00	2590.00
Urad	103.0	140.0	110.0	2100.00	1650.00	37.0	7.0	555.00	112.00
Gram	161.5	325.0	368.0	3575.00	4416.00	163.5	206.5	1798.50	2478.00
Oilseeds	367.0	397.0	471.0	6947.50	8478.00	30.0	104.0	525.00	1872.00
Mustard	366.0	397.0	471.0	6947.50	8478.00	30.0	104.0	525.00	1872.00
Vegetables	1108.0	3,560.0	4,497.0	13387.0	17767.26	2452.0	3389.0	9537.00	13746.00
Leafy	345.0	635.0	520.0	1651.00	1508.00	290.0	175.0	754.00	508.00
Tubers & Roots	418.0	900.0	1,210.0	3150.00	4416.50	482.0	792.0	1687.00	2890.00
Others	345.0	2,025.0	2,767.0	8586.00	11842.76	1680.0	2422.0	7096.00	10348.00
Spices	251.0	672.0	795.0	10416.0	10510.0	421.0	544.0	7722.00	8230.00
Chillies	12.0	38.0	45.0	1140.00	1350.00	26.0	33.0	780.00	990.00
Garlic	43.0	320.0	315.0	5760.00	5040.00	277.0	272.0	4986.00	4352.00
Onion	180.0	246.0	350.0	1476.00	1400.00	66.0	170.0	396.00	680.00
Coriander	16.0	68.0	85.0	2040.00	2720.00	52.0	69.0	1560.00	2208.00
Total		7804.0	8621.0	51255.5	56728.76	3895.0	4712.0	24455.00	29145.00

Prices of produce were calculated on the basis of prevailing rates in the local market.

Net Income

- (2001-02) - Rs. 41,899.50
- (2002-03) - Rs. 49,776.76

Table 2. Annual family expenses & net saving:

Sr. No.	Particulars	2001-02	2002-03
01	Foods	26800.50	27583.76
02	Clothes & Education	2,700.00	3,000.00
03	Social functions	1,850.00	2,540.00
04	House Maintenance	1,000.00	1,000.00
05	Miscellaneous	1,850.00	1,500.00
	Total Expenditures	34,200.50	35,623.76
	Net Saving	7699.00	14153.00

Conclusion:

From the above results it can be concluded that crop diversification by incorporating pulses, oilseeds, vegetables and other cash crops in a scientific cropping pattern can play an important role in increasing farm incomes and employment to achieve nutritional security. Further, as the average family land holdings at the national level have come to 1.6 acres, intervention on 1.5 acre subsistence farming is also needed. Such studies can make a difference to the livelihood as well as food & nutritional security to the people. As such, the focus of extension functionaries should shift to organic farming system diversification.

1.5-acre model for subsistence farming:**Kharif, Rabi & Zaid:**

Objective	Farmers Practice	Innovative technology to be demonstrated
Conversion of uneconomical land holding into economical ones through appropriate utilization of resources and diversification of crops. To overcome malnutrition among marginal farmers.	- Traditional farming - Growing cereal crops only (Paddy/Wheat)	1. Change in cropping pattern as per the needs of the family 2. Planning and layout. 3. Sowing technique. 4. Sowing time. 5. Use of culture. 6. Irrigation management. 7. Fertiliser management. 8. Insect/pest management. 9. Safe storage of grains.

Basic food requirements of six members family (according to NIN, Hyderabad)

Sl. No.	Particulars	Per head per day requirement (gm.)	Food requirement/ Annum (kg)	Family requirement + 5% surplus for family guest
1	Cereals	425	931	977
	Rice	200	438	460
	Wheat flour	225	493	517
2	Pulses	70	153	161
3	Oils	35	77	80
4	Vegetables	285	624	655
	Leafy	100	219	230
	Tubers and roots	85	186	195
	Other vegetables	100	219	230
	Spices		158	166
	Chillies		8	8
	Garlic		12	13
	Coriander		10	11
	Onion		120	126
	Turmeric		8	8
5	Milk	214	469	492

Total requirement of family (Food requirement of family + 5% surplus for family guest + Seed for next year.)

Sl. No.	Particulars	Family requirement + 5% surplus for family guest (Kg)	Seed for next year sowing (Kg)	Total requirement (Kg)
1	Cereals (Food grains)	1225	52	1277
	Paddy	708	32	740
	Wheat	517	20	537
2	Pulses	161	32	193
3	Oilseeds	244	1	245
	Mustard	244	1	245
4	Vegetables	655		705
	Leafy	230		230
	Tubers and roots	195	50	245
	Other vegetables	230		230
5	Milk	492		492

Layout and Planning

Kharif

Paddy (JR-75) - 1 acre				
Urad (PU-30)-0.25 acre	Tomato-.05 acre		Chillies 0.05 acre	
	Brinjal 0.025 acre	Okra 0.025 acre	Lobia 0.025 acre	
	Spinach 0.025 acre	Amaranthus 0.025 acre	Ginger 0.0125 acre	Turmeric 0.0125 acre

Rabi

Wheat - 0.5 acre		Gram 0.375 acre			
Mustard 0.25 acre	Berseem 0.075 acre	Cabbage 0.05 acre		Onion 0.05 acre	Tomato 0.05 acre
		Fenugreek 0.025 acre		Potato 0.05 acre	
		Spinach 0.025 acre	Pea 0.025 acre	Ginger 0.0125 acre	Turmeric 0.0125 acre

Zaid

Fallow/green manuring		Fallow/green manuring			
Fallow/green manuring	Berseem 0.125acre	Lobia 0.05 acre		Onion 0.05 acre	Tomato 0.05 acre
		Fenugreek 0.025 acre		Bottle Gourd 0.05 acre	
		Spinach 0.025 acre	Okra 0.025 acre	Tomato 0.05 acre	

Results

The validation of the 1.5 acre model at the farmer's field is under process. The results of 1.5 acre during the Rabi season were found to be quite encouraging.

Details of farming system and crop performance under 1.5 acre model during Rabi season 2004-05

S.No.	Crop	Variety	Area (Acre)	Production (Kg)	Cost of input (Rs)	Total Income (Rs)	Net Income (Rs.)
1.	Cereal				913.00	4069.00	3156.00
	Wheat	GW-273	0.5	626	913.00	4069.00	3156.00
2.	Pulse				512.00	2240.00	1728.00
	Gram	KGD-1168	0.375	160	512.00	2240.00	1728.00
3.	Oilseed				265.00	1980.00	1815.00
	Mustard	NDR-8501	0.25	117	265.00	1980.00	1815.00
4.	Vegetable				974.00	4643.00	3669.00
	Pea	Arkel	0.125	230	385.00	2836.00	2451.00
	Cauliflower		0.05	150	69.00	600.00	531.00
	Cabbage	Golden Acre	0.05	55	100.00	220.00	120.00
	Brinjal		0.0125	25	20.00	200.00	180.00
	Potato	K. Chandramukhi	0.05	120	400.00	637.00	237.00
	Radish	Pusa Chetaki		300	20.00	150.00	130.00
5.	Spices				522.00	3364.00	2842.00
	Coriander	Morakkan	0.0125		45.00	1460.00	1415.00
	Chillies	Pant C-1	0.0125	2	62.00	24.00	-38.00
	Fenuegreek	PEB	0.0125	5	15.00	200.00	185.00
	Garlic	G-41	0.05	56	400.00	1680.00	1280.00
	Total				3106.00	16296.00	13190.00

Comparative study showing increase in yield & income:

Particulars	Before intervention		After intervention	
	Avg. Yield (kg)	Income (Rs.)	Avg. Yield (kg)	Income (Rs.)
Cereals				
Paddy				
Wheat	1450	9425.00	626	4069.00
Pulses				
Urd				
Gram	-	-	160	2240.00
Oilseed				
Mustard	-	-	117	1980.00
Vegetables			612	4643.00
Spices			103	3364.00
Total		9425.00		16296.00

Prices of produce were calculated on the basis of prevailing rates in the local market.

Particulars	Before Intervention	After Intervention
A. Cost of Inputs	2128.00	3106.00
B. Gross Income	9425.00	16296.00
Net income	7297.00	13190.00

Change in Income

Rs. 5,893.00

2.5 acre model (irrigated + rain fed). A step by step guide

