1.5 ACRE –A HORTI BASED FARMING SYSTEM MODEL FOR FOOD AND NUTRITIONAL SECURITY TO RESOURCE POOR FARMERS- A Case Study

It is apparent that the development of high yielding varieties of crops and breeds of 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.

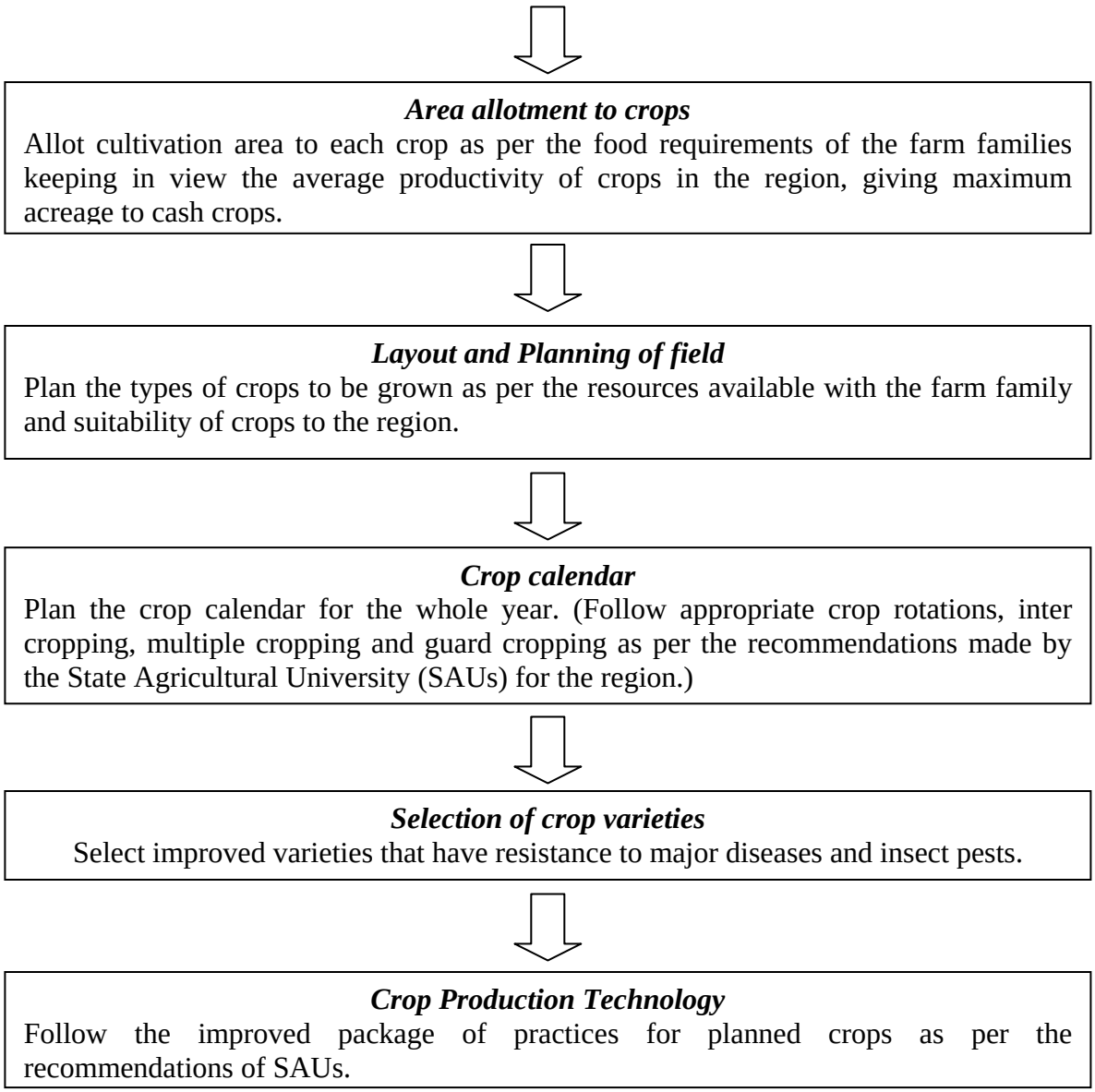
The large-scale cultivation of improved crop varieties together with efforts to maintain good soil fertility and water management helps to increase production through higher yield per hectare. Land is a shrinking resource for agriculture. A rational land use plan is needed to increase agricultural production 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 reducing the gap between realizable 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 61 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 and 1.5 acre horticulture-based farming system model were formulated and tested at the KVK, farm, Satna, with the objective of providing sustainable food and nutritional security along with sufficient income. After the success of these models at the KVK farm, the models were replicated at farmer's fields for further validation and to help spread it to other neighboring farmers. The guidelines followed in selecting the crops and cropping systems are presented hereunder.

Know the family requirement of food

Calculate the annual food requirements of a family by taking the average balanced diet requirements for men and women for moderate type of work, as per the recommendations of National Institute of Nutrition, Hyderabad or ICMR, New Delhi.



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

Achievements

The KVK at Satna has validated the model on 1.5 acre in Deora village in Majhgawan Tehsil during 2005-06 and 2006-07. The results obtained on the 1.5-acre farm of Shri Ansuiya Kushwaha, as presented below, corroborate the concept of farm planning on a small land holding as per family requirement.

Shri Ansuiya Kushwaha of village Deora in Majhgawan Tehsil, having 6 family members possess 1.5 acre of land. Detailed survey of the farm family conducted in year 2005 revealed that the

farmer despite having 1.5 acre of land and a well –perennial source of water, was not in a position to earn enough to feed his family well. The causes of low income were found to be under utilization of available resources and traditional system of farming. The cropping pattern being adopted by the farmer was Paddy - wheat.

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

Sr. No.	Year	Soil Type	Area (acre)		Crop	Yield (Kg)	Income (Rs.)
01	2004 - 2005	Sandy loam	Kharif	1.50	Paddy	1550	8680
			Rabi	1.50	Wheat	1630	11002.5
	Total					**3180**	**19682.5**

The farmer was getting 31.80-quintal yield with gross income of Rs. 19,682.50 by investing Rs. 2,453 on purchase of critical inputs (seeds, diesel, fertilizers and pesticides).

Whereas, the annual family expenses (food, clothes, education, house maintenance, social functions and miscellaneous) were calculated as Rs. 37,339.00, thus showing a deficit of Rs. 20,109.00 per annum.

Methodology

With a view to convert uneconomical landholding into economical one, intensive cultivation on one and half acres of land was undertaken with the active participation of farm family during 2005-06 and2006-07 in line with the concept of 1.5 acre land holding utilization. The requirements of food grains, pulses, oilseeds vegetables and fruits as computed for the 6- member family has been set out below.

Basic food requirement of a six-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**	**930.75**	**977.29**
	Rice	200	438	459.90
	Wheat flour	225	492.75	517.39
02	**Pulses**	**70**	**153.3**	**160.97**
03	**Oils**	**35**	**76.65**	**80.48**
04	**Vegetables**	**285**	**624.15**	**655.36**

	Leafy	100	219	229.95
	Tubers and roots	85	186.15	195.46
	Other vegetables	100	219	229.95
05	**Milk**	**214**	**468.66**	**492.09**
06	**Fruits**	**140**	**306.6**	**321.93**

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)** ***(a)***	**Seed for next year sowing (Kg)** ***(b)***	**Total requirement (Kg)** ***(c)***
01	**Cereals (Food grains)**	**1224.93**	**40**	**1264.93**
	Paddy (65% yield when converted to rice)	707.54	20	727.54
	Wheat	517.39	20	537.39
02	**Pulses**	**160.97**	**13**	**173.97**
	Blackgram		1.5	
	Greengram		1.5	
	Gram		10	
03	**Oilseeds**	278.5	**8.5**	**287**
	Mustard (33% yield when converted to oil)	151.5	0.5	152
	Soybean(24% yield when converted oil)	127	8	135
04	**Vegetables**	**655.36**		**655.36**
	Leafy	229.95		229.95
	Tubers and roots	195.46		195.46
	Other vegetables	229.95		229.95
05	**Spices**	**149.48**		**149.48**
	Chillies	5.75		5.75
	Turmeric	5.75		5.75
	Ginger	11.50		11.50
	Garlic	5.75		5.75
	Onion	114.98		114.98
	Coriander	5.75		5.75
05	**Milk**	**492.09**		**492.09**

06	**Fruits**	**321.93**		**321.93**

In the 1.5-acre model, 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 the family. The area under each crop was allotted on the basis of average productivity of crop in the region. Crop calendar for the whole year was prepared to enable the farmer to perform various cultural operations timely as shown in the following layout plan.

Layout and planning of field

Kharif

<table>
<tr><td colspan="7">Paddy– 0.5 acre</td></tr>
<tr><td>Soybean - 0.25 acre</td><td>Brinjal 0.03acre</td><td>Tomato- 0.1acre</td><td>Okra- 0.06acre</td><td>Lobia- 0.03acre</td><td>Spinach - 0.03acre</td><td>Radish- 0.03acre</td></tr>
<tr><td rowspan="2">Blackgram -0.25 acre</td><td colspan="2">Chilli- 0.1acre</td><td>Cucurbits-0.08 acre</td><td colspan="2">Turmeric-0.01acre</td><td>Zinger-0.05 acre</td></tr>
</table>

Rabi

Mustard– 0.25 acre				Gram - 0.25 acre		
Wheat– 0.5 acre	Radish-0.05acre	Pea 0.05 acre	Tomato 0.03 acre	Potato - 0.13 acre	Cauliflower - 0.05 acre	Carrot-0.01acre
	Coriander – 0.03 acre	Onion-0.05 acre	Garlic - 0.05 acre	Turmeric-0.01acre	Zinger -0.05 acre	

Zaid

Moong – 0.25 acre				Fallow - 0.25 acre		
Fallow-0.5 acre	Lobia-0.05acre	Tomato 0.05 acre	Fallow 0.03 acre	Cucurbits - 0.13 acre	Okra - 0.05 acre	Fallow-0.01acre
	Radish – 0.05 acre	Spinach-0.05 acre	Coriander - 0.05 acre	Fallow-0.01acre	Fallow-0.03 acre	

Findings

The production obtained from crop-based enterprises on the respective allotted areas is furnished below. It is apparent from the production data the intensive cultivation model resulted in substantial increase in yield and income over the traditional system of cropping. Shri Kushwaha has harvested 13.22 and 13.35quintal food grains; 3.48 and 3.81 quintal pulses; 3.19 and 3.14 quintal oilseeds; 54.49 and 60.93 quintal vegetables; 5.38 and 5.89 quintal spices during the year 2005-06 and 2006-07 respectively, which is more than his annual requirement of food grains (12.65 quintal), pulses (1.74 quintal), oilseeds (2.87 quintal), vegetables (6.55 quintal) and spices (1.50 quintal). The production of year round vegetables (47.94 and 54.37 quintal) was so excess than required (6.55 quintal) that gave Shri Kushwaha an opportunity for earning cash through sale of the surplus vegetables. Spices production was to the tune of 3.88 and 4.39 quintal during the year 2005-06 and 2006-07 respectively, which again offered scope for cash earning.

Table -1 Data showing crop yield and income from 1.5 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.)	
		2005-06 *(d)*	2006-07 *(e)*	2005-06	2006-07	2005-06 *(d-c)*	2006-07 *(e-c)*	2005-06	2006-07
Cereals	**1264.9**	**1322.0**	**1335.0**	**9183.0**	**9475.5**	**57.1**	**70.1**	**418.7**	**1044.4**
Paddy	727.5	732.0	705.0	4758.0	4852.5	4.5	-22.5	24.1	349.8
Wheat	537.4	590.0	630.0	4425.0	4623.0	52.6	92.6	394.6	694.6
Pulses	**174.0**	**348.0**	**381.0**	**6972.0**	**8107.0**	**174.0**	**207.0**	**3457.2**	**4337.0**
Urad	58.0	68.0	**53.0**	1428.0	1219.0	10.0	-5.0	210.0	-115.0
Moong	58.0	51.0	47.0	1173.0	1034.0	-7.0	-11.0	-161.0	-242.0
Gram	58.0	140.0	164.0	2772.0	3444.0	82.0	106.0	1623.6	2226.0
Oilseeds	**287.0**	**319.0**	**314.0**	**4730.0**	**4739.0**	**32.0**	**27.0**	**489.4**	**400.5**
Soybean	152.0	165.0	168.0	2112.0	2184.0	13.0	16.0	166.4	208.0
Mustard	135.0	154.0	146.0	2618.0	2555.0	19.0	11.0	323.0	192.5
Vegetables	**655.4**	**5449.0**	**6092.0**	**29139.6**	**35282.9**	**4793.6**	**5436.6**	**25474.8**	**31188.1**
Leafy	230.0	569.0	657.0	3638.8	4892.2	339.1	427.1	2169.9	3181.5
Tubers & Roots	195.5	1642.0	1795.0	7948.4	9693.0	1446.5	1599.5	7001.3	8637.5

Others	230.0	3238.0	3640.0	17552.4	20697.7	3008.1	3410.1	16303.6	19369.1
Spices	**149.5**	**537.8**	**588.8**	**7906.6**	**8380.0**	**388.3**	**439.3**	**6661.2**	**7446.1**
Chillies	5.8	41.0	46.0	1558.0	1840.0	35.3	40.3	1339.5	1610.0
Turmeric	5.8	10.8	12.8	399.6	512.0	5.1	7.1	186.9	282.0
Ginger	11.5	187.0	209.0	2618.0	2508.0	175.5	197.5	2457.0	2370.0
Garlic	5.8	154.0	143.0	2556.4	2574.0	148.3	137.3	2461.0	2470.5
Onion	115.0	134.0	169.0	455.6	676.0	19.0	54.0	64.7	616.1
Coriander	5.8	11.0	9.0	319.0	270.0	5.3	3.3	152.3	97.5
Fruits	**321.9**	**163.0**	**358.0**	1589.3	3669.5	**-158.9**	**36.1**	**-1549.6**	**370.0**
Total	**2852.7**	**8138.8**	**9068.8**	**59520.5**	**69653.9**	**5286.1**	**6216.1**	**34951.7**	**44786.1**
Milk	**492.09**	**536**	**584**	**5896**	**7008**	**43.91**	**91.91**	**483.01**	**1102.9**
	3,344.8	**8,674.8**	**9,652.8**	**65,416.5**	**76,661.9**	**5,330.0**	**6,308.0**	**35,434.7**	**45,889.0**

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

The farmer obtained gross income of Rs.65, 417 and Rs.76, 662 from the same holding by investing Rs. 7,640 and Rs 5,670 on purchase of critical inputs (seeds, diesel, fertilizers and pesticides). Comparative advantage made between before and after intervention based on the commodity price structure prevailed during 2005-06 and 2006-07 reveals that Shri Kushwaha could have earned net income of Rs.17, 230 from his 1.5 acre farm which he has obtained Rs.58, 777 and Rs.70, 992 from the same holding by application of 1.5 acre model farming systems. An increased in net income by Rs. 41,547 and Rs.53, 762 respectively during the year 2005-06 and 2006-07 per annum from 1.5 acre is indeed substantial. After excluding all the annual family expenses, a net saving of Rs. 18,095.00 and Rs. 29,049.00 was achieved during the year 2005-06 and 2006-07 respectively.

Further, it is praiseworthy to mention that the 1.5-acre model farming was visited by Correspondent of India Today and could find place in the Magazine. Shri Kushwaha has received first prizes each on seven (7) occasions in 2006-07 in district level kisan melas differently for the enterprises he has raised in 1.5 acre, which also indicates his conviction and devotion to use the small land holding into profitable mode using the model.

The findings narrated above are from one out of seven (7) sites in different villages implemented by the KVK Satna on 1.5 acre. Similar findings have also been recorded from the other six (6) sites.

Table 2. Annual family expenses & net saving:

Sr.No.	Particulars	2005-06	2006-07
01	Foods	29,982.00	30773.00
02	Clothes & Education	3,700.00	3,900.00
03	Social functions	1,850.00	2,540.00
04	House Maintenance	1,000.00	1,000.00
	Medical Treatment	2,300.00	1,240.00
05	Miscellaneous	1,850.00	2,500.00
	Total Expenditures	**40,682.00**	**41,953.00**
	Net income	**58,777.00**	**70,992.00**
	Net Saving	**18,095.00**	**29,039.00**

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 down, interventions are further needed to convert such un economic landholdings into profitable one. 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 farming system diversification.

Impact Assessment of watershed and improved crop production technologies on socio economic status of tribal villages – A Case Study

The villages where the Deendayal Research Institute has focused there activities during the last 10 years, are tribal villages situated in the ravines near Majhgawan, a little known block in Satna district of Madhya Pradesh. These villages are deep inside the forests and are connected with a kachha pathway, which get washed off every rain, or else villagers have to walk through the hills for 5-10 km to reach the nearest weekly *haat*, as the weekly markets are known. When the DRI volunteers first arrived in those remote tribal villages, found that these poor villagers were facing an acute shortage of drinking water and had to go some 4-5 km to fetch potable water. Water scarcity, soil erosion, very low productivity of crops and out migration of young human force were identified the major problems and constraints for the poor socio economic status of tribal of the region through PRA survey. At that time agriculture was a secondary enterprise & villages were heavily dependent on forests. The productivity of crops was barely sufficient to meet even one fourth of the requirements of these villages. Forest produce collection and remittance received from out migrated family members were the important sources of their sustenance So on priority basis Deendayal Research Institute decided to provide potable water and DRI initiative in this area began with watershed programme in 1996 under Rajiv Gandhi Mission for Watershed management programme aiming at bringing a perceptible change in land use pattern in the area to achieve economic, environmental and livelihood security with social equity and employment opportunities on sustainable basis. The Watershed Development in 18 tribal villages was completed in 2002.

Integrated watershed development in the socially and economically backward tribal villages has proved a viable strategy to improve productivity of rain fed agriculture and socio economic status of tribal communities. The watershed management has given the area economic benefits that are far greater than the sum of its parts. This has changed the overall scenario of the treated area with increase in water level, increased agricultural and forest produce production; increased employment opportunities. A significant change in land use has taken place. Watershed development in the area resulted in significant increase in area under cultivation (132.91 %). The culturable wastelands and fallow lands have decreased by 26.67 % and 96.62 % respectively. An increase of 480.31 % in irrigated area was observed. An increase of 2.83 m and 3.0 m in ground water table was observed in the month of May and December. Increased irrigation facilities and improved crop demonstrations encouraged the farmers to adopt new crop production technologies, which significantly increased the yield of crops by 27.01 to 131.7 %. The productivity of paddy, wheat, gram and mustard increased by 53.24 %, 43.25 %, 58.02 % and 68.40 % respectively. The area under improved varieties increased from 12.2 ha to1980.5 ha. A perceptible improvement was observed in the quality of life.

The average family income became doubled with in a short period of 5 years. Improvement in the economic conditions, led change in attitude of tribal families towards the education, health, environmental protection human right, self realization, for future production and cooperative life. In the beginning of the project where only 55 children were noticed to go school, but with improvement of life style of villagers in the area in 2007, 1174 students were recorded to seek education. Even most of the tribal families have started to send their children in Chitrakoot and Satna for better education. Awareness about environmental protection has been realized by villagers as a result more forest restoration is visible. The GDP of these 18 villages was

observed to increase by 82.41 % and the watershed development programme was found to be economically viable with B: C ratio of 1.67.