

On-farm Integrated Farming System models in arid regions: Experiences from Utambar village

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Introduction

The arid region in western Rajasthan is characterized by hostile and harsh agro-climatic conditions. Only 18 percent of arable land is irrigated and rest is dependent on monsoon. The average rainfall in the region is only 320mm with high coefficient of variation. Two to three droughts in every five year cycle is common. The traditional arable cropping is risky and has become less remunerative on account of all these factors. The effective solution to address the issues of economic viability and sustainability of farms is to adopt the Integrated Farming System (IFS). IFS in western Rajasthan could be promoted by integrating different components of agriculture and allied enterprises and technologies such as horticulture, vegetables, agro-forestry, silvi-pasture, animal husbandry, value addition and processing along with traditional arable crops. CAZRI has done significant R&D in development of different IFS models suited to different farmer categories under arid conditions. A long-term study undertaken by CAZRI on IFS on a 7 hectare area found that 30% proportion of agri-horti, 20% of agro-forestry, 25% of agri-silviculture, 15% of agri-pasture and 10% under silvipasture system is very effective combination for providing food, fodder, fuel and maintaining soil fertility.

Traditional farming systems in western Rajasthan

About 82% area in western Rajasthan is rainfed and being cultivated only in rainy season. Mixed cropping is the traditional method of cultivation. Under this practice, seeds of many kharif crops in different proportions like pearl millet (40 to 60%), mung bean (10 to 20%), moth bean (10 to 20%), cluster bean (10 to 15%) and sesame (5 to 10%) are mixed and broadcasted/sown at the onset of monsoon without using or with very little use of external inputs. Low input-low risk-low yield concept is still prevailing in the region and average productivity of all the crops is very low (200 to 600 kg/ha). Crop failure is a common feature either due to inadequacy of rainfall or due to shortage of soil moisture to meet the crop requirements during different phases. The crop yields from the existing cropping

system are meager and unstable leading to low incomes. To mitigate the risks and uncertainties of income from conventional cropping, it is essential to integrate various agricultural enterprises and improved production technologies in agriculture. Integrated Farming Systems are an essential component of arid farming. Livestock and agro-forestry components were traditionally common. However, the contribution of components other than crops (such as livestock, horticulture, agro-forestry, etc.) may be too low because the existing Farming Systems under farming conditions may be in degraded state or not fully exploited.

The traditional farming system in western Rajasthan has evolved over centuries to adapt to the harsh climatic conditions. It includes components of arable crops, agro-forestry and livestock. The farming system in the region has undergone sea change owing to introduction of irrigation (groundwater and canal irrigation). The improved infrastructure, market access and enabling government policies have further contributed to the change in farming systems. Traditionally, pearl millet, guar, green gram, moth bean and sesame were cultivated in mixed cropping system. Pearl millet was the dominant component and the other crops were grown as per domestic requirement. Kharif season was the only growing season for rainfed conditions. Introduction of irrigation has enabled farmers to cultivate cotton and castor in kharif season and cumin, rapeseed and mustard, Isabgol and wheat in rabi season. Vegetables such as chilly, tomato, onion, carrot and garlic are also grown as commercial crops under irrigated conditions.

Development of IFS models on farmers' fields

The institute is also developing and disseminating on-farm IFS models in farmers' field on participatory mode in Utambar village in Balesar block of Jodhpur district. Horticulture, vegetables, grass and forage crops, animal husbandry interventions were made along with promotion of improved cultivars in traditional arable crops.

Table 1: Improved cultivars of arable crops demonstrated under IFS mode (2012-13 to 2019-20)

Sl. No.	Crop	Improved varieties	Number of Demonstrations
1	Pearl millet	HHB-67 Improved, RHB-177, MPMH-17	47
2	Green gram	RMG-492, SML-668, GM-4, IPM 2-3, GAM-5	44
3	Guar	RGC-936, RGC 1017, RGM-112, RGC-1033, HG-2-20	43
4	Mothbean	CZM-2	11
5	Cumin	GC-4	54
6	Rayada/ Mustard	Pusa Jaikisan, Ashirvad, RGN-229, Laxmi, NRCHB-101	36
7	Wheat	Raj 4043, Raj 4083, Raj 4120, Raj 4079, Raj 4238	30
	Total		265

Table 2: Improved cultivars of fodder and vegetable crops demonstrated under IFS mode (2012-13 to 2019-20)

Crop	Number of Demonstrations	Crop	Number of Demonstrations
Fodder bajra	10	Spinach	14
Napier grass	3	Raddish	12
Lucerne (Alamdar-51)	4	Tomato	7
Dhaman grass (<i>C. ciliaris</i>)	1	Peas	5
Modha Dhaman grass (<i>C. setigerus</i>)	1	Carrot	5
Total	19	Ridge gourd	6
		Lady finger	5
		Brinjal	5
		Bottlegourd	5
		Total	64

Table 3: Improved cultivars of horticultural crops demonstrated in Utambar under IFS mode (2012-13 to 2019-20)

Sl. No.	Crop	Cultivars	Number of Demonstration Units	Number of trees planted
1	Ber	Gola	4 farms	60
2	Goonda	CAZRI Goonda	4 farms	350
	Total			410

Table 4: Livestock based scientific interventions under IFS mode

Sl. No.	Scientific/ Technological Interventions	Remarks
1	Multi-nutrient feed mixtures/blocks	Twice in a year
2	Deworming of livestock	Every 3 months/ As per need
3	Animal health camps	Twice a year/ As per need

Table 5: Extension and capacity building interventions to promote IFS

Sl. No.	Extension Interventions	Remarks
1	Field Demonstrations/ Front Line Demonstrations	Kharif, rabi and summer season
2	Field Days	Once each in kharif and rabi season
3	On and off-campus trainings	Throughout the year as per need
4	Group discussions	During every field visit
5	Exposure visit to CAZRI research and demonstration units	Twice a year/ As per need
6	Exposure visit to CAZRI Kisan Mela	Once/twice a year
7	Extension literature, Agricultural advisories	As per need
8	Soil health cards	Once



Introduction of goonda as horticulture component for sustainable income



Cultivation of fodder bajra during off-season for livestock

Performance of different components in Integrated Farming System at farmers' field

The study was conducted in the integrated farming systems developed at small, medium and large farmers of Village Utambar to assess the productivity of different components of the system. Scientific interventions were compared with the existing farmer's practice of production. The results on grain and stover yield obtained from arable crops were presented in Table 6. Improved production technology in arable crops significantly increased production of crops over the farmers practice. The improved varieties i.e. MPMH-17 of pearl millet and GM-4 of green gram were grown with improved crop production technologies. The increase in yield due to improved crop production technologies was 21.65 and 18.2 for pearl millet and green gram respectively. The performance of crops in agri-horticulture was more or less comparable to each other for all the three crops under all the farmers' category. The productivity of crops varied among farmers' categories. The yield of crops obtained was higher with medium farmers followed by large and small farmers. The percent increase in yield of crops was also higher with medium category of farmers. The increase in yield was 14.29, 29.6 and 21.05 for pearl millet, 14.58, 20 and 20 for green gram at large, medium and small farmers, respectively. The highest increase in crop production due to improved technology with medium farmers might be due to better management of resources as compared to other categories.

For assessing system productivity, along with improved crop production technologies, crop diversification, vegetable cultivation and livestock management practices were included to increase the production and income of the farmers. The monetary returns from different