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Resilient intercropping system for Northern dry zone of Karnataka



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In the Northern dry zone of Karnataka, the cultivated area under the rainfed situation is 32.3 lakh ha. The region is characterized majorly dry semi arid climate with the probability of two drought years out of five years. Potential evapo transpiration is 1676 mm while, the mean annual rainfall is 594 mm. The length of growing period is 90-120 days. The major soil types are medium to deep black soils. Under the rainfed situation, the major crops cultivated during kharif are pearl millet, pigeonpea, greengram, groundnut, maize while sorghum, chickpea, sunflower and safflower during rabi season.

In recent years, the weather abrasions such as delayed on set of monsoon, seasonal drought and other extreme events are impacting on net crop sown area, performance and yield of prominent crops and ultimately on agricultural production.

AICRPDA-NICRA programme

Under NICRA, the AICRPDA Vijayapura since 2011 had been demonstrating the simple doable resilient rainfed technologies/practices to cope with various weather abrasions in the region, the AICRPDA- NICRA programme being implemented, both on station and on farm (at village level). The main focus had been the demonstration of real time contingency crop plan implementation (RTCP) under on farm situation in a participatory mode. The centre adopted Kavalagi village for demonstrating this programme.

AICRPDA- NICRA Village profile

The program is being implemented in Kavalagi village, Vijayapura tehsil in Vijayapura district, Karnataka. The total cultivated area is 1327 ha out of which 1307 ha is rainfed. The mean annual rainfall is 606.8 mm with seasonal rainfall of 387.5 mm during kharif (June - September). The major soil types are shallow to medium deep black soils, shallow red soils and gravelly soils.



Location of the Kavalagi village in the Karnataka and in Vijayapura district

The major rainfed crops during *kharif* are pearl millet, pigeonpea, greengram, groundnut, maize and sorghum, chickpea, wheat, sunflower and safflower during *rabi* season. The number of small, marginal, medium and large farmers is 144, 53, 200 and 04, respectively. The ground water table is 70-80 m. below ground level. The source of irrigation is open and bore-wells covering 1.5% of cultivated area.

Resilient Practice Introduced

Among the different technologies demonstrated, compartment bunding is one of the technology, which is well accepted by the farmers. the details of the technology, the performance, the impact and the performance are discussed in this bulletin.

The farmers in the region grow *rabi* sorghum and chickpea as a sole crop, in some cases they take intercropping of *rabi* sorghum + chickpea in 1: 5 ratio in medium to deep black soils. There will be complete failure of sole crops due to prolonged dry spells during the cropping season.

Rabi sorghum and chickpea are sown simultaneously in 2:4 row proportion by a tractor drawn automatic seed cum fertilizer drill or bullock drawn seed cum fertilizer drill. The spacing between the rows will be 45 cm. It is recommended to apply 30 : 40 kg N, P₂O₅ per ha.

Similarly, safflower and chickpea are sown simultaneously in 2:4 row proportion by a tractor drawn automatic seed cum fertilizer drill or bullock drawn seed cum fertilizer drill. The spacing between the rows will be 45 cm. It is recommended to apply 30 : 45 : 04 kg N, P₂O₅, K₂O per ha.

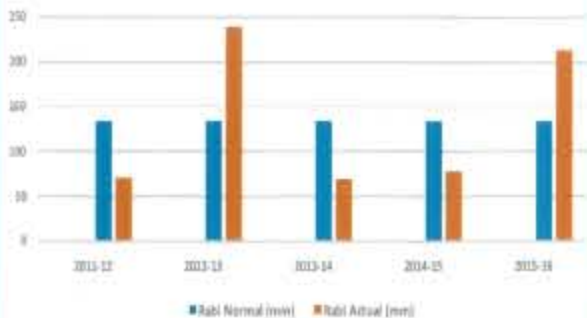
Weather experienced during 2011-2015.

The onset of monsoon was delayed in 2014-15 (July 5) by 28 days, however, the onset of monsoon was quite normal during the years 2011, 2012, 2013 and 2015. Further, the early, mid season and terminal droughts are very common phenomena in the NICRA village. The dry spells of more than 10 days occurred 3, 1, 2, 3 and 3 times during the year 2011-12, 2012-13, 2013-14, 2014-15 and 2015-16 respectively at various stages of the crop growth (Table 1), it was also noticed that during *rabi* season, after sowing hardly one or two rainfall events were observed, further there would be long dry spell.

Year	Onset of Monsoon	Phase	Weather	Remarks	Remarks
2011-12	1	10/7/11	Normal	Normal	Normal
	2	10/7/11	Normal	Normal	Normal
2012-13	1	10/7/11	Normal	Normal	Normal
	2	10/7/11	Normal	Normal	Normal
2013-14	1	10/7/11	Normal	Normal	Normal
	2	10/7/11	Normal	Normal	Normal
2014-15	1	10/7/11	Normal	Normal	Normal
	2	10/7/11	Normal	Normal	Normal
2015-16	1	10/7/11	Normal	Normal	Normal
	2	10/7/11	Normal	Normal	Normal

Table 1.
Details of dryspells
during 2011-15

Rabi crop seasonal rainfall (mm) during 2011 to 2016



*For different crops date of harvesting is almost same, however, the date of harvesting is differ from crop to crop, during rabi later stage of the crop growth there would be no rainfall. Hence, atual crop seasonal rainfall would remain same for all the crops.

The *Rabi* Crop seasonal rainfall graph reveals that actual rainfall in three years out of five years was far less than the normal rainfall.

Performance:

The compartment bunding in the *rabi* sorghum and chickpea system enhanced in-situ moisture conservation with mean rain water use efficiency of 16.58 and resulted in mean *rabi* sorghum equivalent yield of 2668 kg/ha with mean net returns of Rs. 42594 per ha. In case of safflower and chickpea system enhanced in-situ moisture conservation with mean rain water use efficiency of 11.98 and resulted in mean safflower equivalent yield of 2273 kg/ha with mean net returns of Rs. 42237 per ha. This higher yield is more significant even during the years of low rainfall (four years out of five years received the less than the normal rainfall). Further, during the year 2011-12, there was no rainfall after 11th September and also during the year 2015-16, there was no rainfall after 2nd October. In addition to this, the *rabi* seasonal rainfall recorded during the years 2011-12, 2013-14 and 2014-15 was around 50 per cent less than the normal. Hence adoption of intercropping of *rabi* sorghum + chickpea (2:4) will help to overcome the impact of prolonged dry spell and also in maintaining the soil fertility status.

Rabi sorghum production 2000 (kg/ha)

Year		2012-13	2013-14	2014-15	2015-16	Mean
Sorghum	Sorghum + chickpea (2:4)	1302	4115	2894	1529	2868
Equivalent	Farmers practice	993	2049	3209	945	3034
Yield (kg/ha)						
Net return (Rs/ha)	Sorghum + chickpea (2:4)	14400	37877	30533	20700	42949
	Farmers practice	10842	34738	35133	20000	30803
W.C. ratio	Sorghum + chickpea (2:4)	3.7	15.3	8.46	3.92	8.30
	Farmers practice	2.7	10.2	5.41	2.11	5.83
SWIR (Kg/ha-cum)	Sorghum + chickpea (2:4)	3.61	22.8	15.39	23.09	16.38
	Farmers practice	2.45	13.2	11.87	18.61	11.47
Percent increase in Sorghum equivalent yield (Kg/ha)		31.77	40.20	14.34	61.90	25.44
Additional income (Rs/ha)		3617	21191	15030	9294	11784

Safflower equivalent yield (kg/ha)

Year		2012-13	2013-14	2014-15	2015-16	Mean
Safflower	Safflower + chickpea (2:4)	1009	7284	3827	992	2772
Equivalent	Farmers practice	830	1961	3178	561	1872
Yield (kg/ha)						
Net return (Rs/ha)	Safflower + chickpea (2:4)	10973	32753	39142	11110	42272
	Farmers practice	8721	20503	24680	10980	30126
W.C. ratio	Safflower + chickpea (2:4)	2.7	14.4	8.34	1.73	6.47
	Farmers practice	1.8	8.2	4.87	1.89	4.61
SWIR (Kg/ha-cum)	Safflower + chickpea (2:4)	3.34	14.3	16.54	17.79	11.98
	Farmers practice	2.01	9.9	14.63	14.99	9.13
Percent increase in Safflower equivalent yield (Kg/ha)		18.71	67.47	19.79	41.71	34.31
Additional income (Rs/ha)		4294	24450	14463	1110	12892

Impact:

Over the period of five years farmers in the NICRA village were convinced about the performance of these intercropping systems, even during the abnormal years. The intercropping of sorghum + chickpea (2:4) was adopted in 120 ha by 75 farmers while intercropping of safflower + chickpea (2:4) was adopted in 65 ha by 20 farmers during 2012-2015 in Kavalagi watershed area (Vijayapura district) and also by the farmers of the neighboring villages viz., Madbhavi, Honnutagi and Kumatagi. These intercropping systems were popularized through organization of the field days, publishing the popular articles in electronic and press media. This has resulted in further spread of technology in the Vijayapura district.

Scope:

In Northern dry zone of Karnataka, rabi sorghum is grown around 6 lakh ha in black soils. If this technology is adopted by at least 20 per cent of the chickpea area, the additional monetary benefit would be around Rs. 140.76 crores from intercropping of rabi sorghum + chickpea (2:4) while Rs. 144.98 crore from intercropping of safflower + chickpea (2:4). The area under intercropping of safflower + chickpea (2:4) is less due to the problem of harvesting of safflower. These two resilient intercropping systems can be popularised through large scale demonstrations in convergence with line departments, also on farm demonstrations by KVK's, ATMA and NGOs.



Safflower + chickpea (2:4) intercropping



Rabi sorghum + chickpea (2:4)

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