

National Innovations on
Climate Resilient Agriculture (NICRA)

Soybean + Pigeonpea (4:2) intercropping system

A risk resilient system for
Marathwada Region of Maharashtra



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All India Co-ordinated Research Project for
DRYLAND AGRICULTURE
(ICAR-CRIDA)

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Marathwada region is one of the four regions of Maharashtra state, comprising eight districts viz. Parbhani, Nanded, Hingoli, Beed, Latur, Osmanabad, Aurangabad and Jalna with cultivable area of 5.6 Mha and 83 per cent of cultivated land is rain dependent. South-west monsoon is the main source of rainfall in the region, receiving about 90 percent of annual rainfall. The climate of Marathwada experiences wide inter districts and intra districts variability.

Agro-climatically the region is divided into three zones. The Central Maharashtra plateau zone is the biggest one with assured rainfall pattern. Towards the western end, the parts of Aurangabad, Beed, Osmanabad come under the scarcity, whereas the north eastern part of the region has moderately high rainfall.

AICRPDA-NICRA programme

AICRPDA-NICRA Parbhani centre since 2011 had been demonstrating the simple doable resilient rainfed technologies/practices to cope with various weather aberrations in the region. The main focus had been the demonstration of real time contingency crop plan implementation (RTCP) under on farm situation in a participatory mode. The research centre adopted Babhulgaon village for demonstrating this programme.

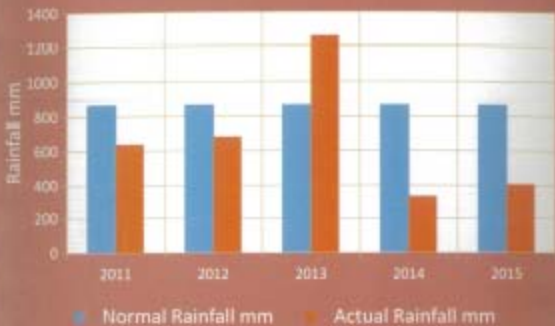
AICRPDA-NICRA Village profile

The program is being implemented in Babhulgaon village, Tq. and Dist Parbhani, Maharashtra located at 19.166514°N Latitude, 76.42159° East Longitude and 357 m above Sea Level and at a distance of about 20 km away from Parbhani. The normal rainfall of the area is 824.1 mm with 87 per cent rainfall occurred in June to September. The total cultivated area is 1133.94 ha out of which 1015 ha is rainfed. The major soil types are shallow to medium deep black soils. The major rainfed crops cultivated during *kharif* are soybean, cotton, pigeonpea, greengram, blackgram, and sorghum. The major crops grown in *rabi* season are *rabi* sorghum, safflower, and gram. The number of marginal, small to medium and large farmers is 105, 445 and 27 respectively. The source of protective irrigation is open-wells and bore-wells.

Weather experienced during 2011-15

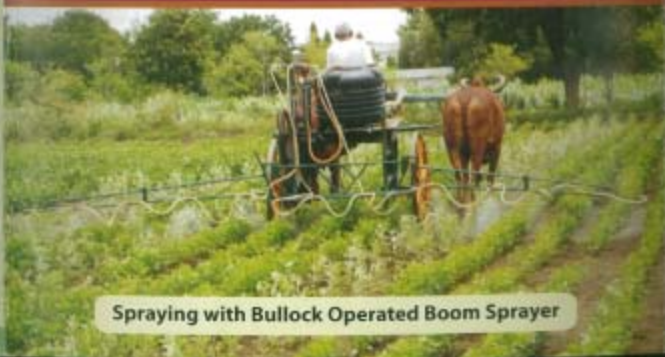
The onset of monsoon was delayed by 30, 15 and 24 days in 2011, 2012 and 2014 respectively. However, onset of monsoon was normal in 2013 and 2015. During 2011, 2012, 2014 and 2015, the actual crop seasonal rainfall received was 639 mm, 681.8 mm, 338 mm and 408 mm and was 26 %, 21 %, 61 % and 53 % less than the normal rainfall respectively. During 2013, 1265 mm of rainfall was received as against of 863 mm normal rainfall and was 46 % excess than the normal rainfall.

Crop seasonal rainfall (Normal and Actual)



Dry spells during crop growing season (2011-15)

During crop growing season, both soybean and pigeonpea experienced dryspells at various stages during 2011 to 2015. During 2015, a prolonged dryspell of 45 days was observed and resulted in severe moisture stress condition.



Spraying with Bullock Operated Boom Sprayer

Dry spells		Stage of crop	Impact of dryspells
Duration (Days)	Period		
10	06.09.11 to 15.09.11	Pod filling in soybean and vegetative stage in pigeonpea	Due to moisture stress, seed size of soybean was affected
09	12.08.12 to 20.08.12	Flowering stage in soybean Vegetative stage in pigeonpea	Pigeonpea able to withstand dry spells during initial stage and recovered with subsequent rains
13	27.00.13 to 08.09.13	Pod initiation stage in soybean Vegetative stage in pigeonpea	Affects on pod formation
10	22.09.13 to 02.10.13	Pod filling in soybean and flowering stage in pigeonpea	Due to moisture stress, seed size of soybean was affected
10	12.08.14 to 21.08.14	Flowering stage in soybean Vegetative stage in pigeonpea	Pigeonpea able to withstand dry spells during initial stage and recovered with subsequent rains
45	20.06.15 to 04.08.15	Vegetative stage in soybean and pigeonpea	Affected vegetative growth of soybean Pigeonpea able to withstand dry spells during initial stage and recovered with subsequent rains

Existing practice :

Soybean in Marathwada region of Maharashtra state is cultivated in 15 lakh ha area during *kharif* in medium black soils under rainfed situations. Soybean is also cultivated under delayed monsoon situations. Normally farmers are cultivating sole soybean crop on flat bed with available varieties in market. However, yield reductions were observed due to moisture stress because of occurrence of dryspells during crop growth period. The farmers are not following any *in situ* moisture conservation practices except field boundary bunds. Hence, conservation of moisture is most important to cope up with dryspells and for better production.

Resilient/ coping practice


Among the different technologies demonstrated to cope with drought condition, soybean based intercropping system i.e. soybean + pigeonpea (4:2) intercropping is one of the technology, which proved a risk resilient technology and is well accepted by the farmers.

Summer ploughings was carried out on receipt of pre monsoon showers. The sowing of soybean + pigeonpea was done at 4:2 ratio across the slope of with row to row spacing of 45 cm using tractor / bullock drawn seeddrill. The fertilizer dose of 30-60-30 kg/ha of N, P₂O₅, K₂O was applied at the time of sowing. The variety of soybean viz. MAUS-71 and improved variety of pigeonpea BDN-711 was used for sowing.

Performance:

Soybean + pigeonpea (4:2) intercropping system recorded significantly higher soybean equivalent mean yield of 2167 Kg/ha as against the sole soybean mean yield of 1318 kg/ha i.e. farmers practice. The mean net returns in soybean + Pigeonpea intercropping system was recorded as Rs. 36695 /ha as against mean sole soybean net return of Rs. 24778/ha in farmers practice. The BC ratio and RWUE was also higher in soybean + pigeonpea intercropping system as compared to sole soybean crop.

During 2014 and 2015, inspite of more than 50 % deficit rainfall, the intercropping system sustained even in prolonged dryspell during 2015. The dryspell was occurred at flowering and pod filling stage of soybean and vegetative stage in pigeonpea.



Performance of pigeonpea after harvest of soybean

Year		2011-12	2012-13	2013-14	2014-15	2015-16	Mean
Yield (kg/ha)	Soybean + Pigeonpea (4:2) intercropping system	2464	2859	2443	1340	1731	2167
	Sole soybean	1577	2251	1790	446	527	1318
Net returns (Rs./ha)	Soybean + Pigeonpea (4:2) intercropping system	31715	50623	61132	20164	19840	36695
	Sole soybean	26494	39857	44791	6711	6040	24778
B:C ratio	Soybean + Pigeonpea (4:2) intercropping system	1.98	1.64	3.5	1.59	1.62	2.06
	Sole soybean	1.44	1.29	2.56	0.52	0.49	1.26
RWUE (kg/ha-mm)	Soybean + Pigeonpea (4:2) intercropping system	5.52	6.0	2.58	4.74	6.07	4.98
	Sole soybean	3.53	4.72	1.89	1.58	1.85	2.71

Impact:

Soybean + pigeonpea (4:2) inter cropping system was adopted on 190 ha on 170 farmers field during 2011 to 2015 in Babhulgaon village Tq and Dist. Parbhani (M.S.). Five years study revealed that even under delayed monsoon and seasonal drought, adoption of soybean + pigeonpea (4:2) inter cropping system performed better. Adoption of soybean + pigeonpea intercropping system is increasing as pigeonpea is drought tolerant crop, less cost of cultivation and higher market prices in prevailing condition.

Scope for up scaling:

This technology has wider scope to upscale in all districts of Marathwada region in assured rainfall zone area through National accelerated pulse production programme. Short duration drought tolerant variety of pigeonpea (BDN-711) need to be included in the pulse production programme for enhancing the production of pigeonpea and ultimately pulses.