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Impact of climate resilient varieties on crop productivity in NICRA villages of Ratlam district in Madhya Pradesh

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Abstract
Rainfed agriculture which constitutes nearly 58 per cent of net cultivated area will be the most impacted. With this background, ICAR has launched a major network project, National Initiative on Climate Resilient Agriculture (NICRA), during 2010-11. In first phase 100 vulnerable districts were covered under this project adding 21 new districts second phase to undertake strategic research on adaption and mitigation, fill critical research gaps and demonstrate technologies on farmers' fields to cope up with current climate variability and capacity building of different stakeholders. The impact of climate resilient varieties of crops was studied by KVK Jaora, Ratlam during 2017-18, 2018-19 and 2019-20 in NICRA village which Improved Water logging tolerant variety of Soybean RVS-2001-04 given higher yield of 42.0 per cent over traditional variety. The Drought tolerant wheat variety DBW-110 and IH-1605 in Rabi season contributed 21.0 per cent higher yield over local check variety Lok-1. The heat tolerant Chickpea variety JG-14 in Rabi season contributed 18.59 per cent higher yield over local variety.

Keywords: NICRA, Rainfed agriculture, Madhya Pradesh

Introduction
Indian Agriculture faces many challenges posed simultaneously by several sectorial and non-sectorial demands. These challenges become all the more daunting by the extreme weather vagaries that have become a regular feature over the years. Climate change has become an important concern for India to ensure food and nutritional securities for its growing population. Its impact is global, but countries like India are more vulnerable in view of the high population dependency on agriculture (SV Sonune and SB Mane 2018) [5]. National Innovations on Climate Resilient Agriculture (NICRA) launched in February, 2011 and started on Ratlam district in 2015-16. The project aims to enhance resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration. Under the technology demonstrations component (TDC) of NICRA project, an integrated package of proven technologies would be demonstrated in Amba village of Piploda Tahsil of Ratlam district for adaptation with an aim to mitigate the ill-effects of climate variability in crop and production system. The rise in temperature along with the possible changes in spitial and temporal patterns of rainfall poses challenges to sustainable agricultural production. Climate change impacts the crop yields both directly and indirectly. The direct effect is mainly due to change in crop duration and impacts reproductive processes such as pollination and fertilization. While the indirect effect is largely in water availability, altered pest, disease and weed dynamics. The impact of climate change on all crops is obviously not similar, as the model outputs reveal that the yield of wheat and maize will decrease while it could be neutral or positive with soybean and chickpea (Aggarwal, 2008) [1].

Material and Methods
The development and identification of climate resilient crop varieties, with enhanced tolerance to drought, heat, water logging are essential in order to sustain and improve crop yields to cope with the challenges of climate change. It is essential to bridge the yield gaps, enhance the productivity and profitability, minimize risk and improve the livelihood of millions of people dependent on agriculture. Experimental field is NICRA village Amba in Ratlam district and experiment conduct on selected farmer field of NICRA village.

Table 1: Improved climate resilient crop varieties used for cultivation in NICRA Village of Ratlam district.

S. No.	Crop	Variety	Climate resilient varietal character
1	Soybean	RVS-2001-04	Drought and water logging tolerant
2	Wheat	DBW-110	Drought tolerant, Restricted irrigation required
3	Chickpea	JG-14	Heat tolerant varieties
4	Mustard	RH-406	Drought tolerant varieties, Restricted irrigation required

Results

Under NICRA Project, climate resilient crop varieties are one of the most important resources. Improved and tolerant crop varieties along with the proper management practices can enhance the coping ability through risk reduction in vulnerable environment. Ensuring seed availability of the resilient varieties in various crops at the appropriate time to the farmers is an important challenge to address immediately. Demonstrate Soybean variety RVS-2001- 04 performs well in drought & water logging conditions as compare to farmer cultivated local variety. Variety RVS-2001-04 produce higher yield in 2017-18 (1405 kg/ha), 2018-19 (1625 kg/ha) and 2019-20 (1000 kg/ha) whereas farmer cultivated variety produce lower yield in 2017-18 (1125 kg/ha), 2018-19 (1331 kg/ha) and 2019-20 (600 kg/ha) where from increases farmer net income/ha & increases B:C of crop. Demonstrate Wheat variety DBW-110 performs well in drought & restricted irrigation conditions as compare to farmer cultivated local varieties. Variety DBW-110 produce higher yield in 2017-18 (3335 kg/ha) and 2019-20 (3750 kg/ha) now those farmer cultivated variety produce lower yield in 2017-18 (2971 kg/ha) and 2019-20 (3098 kg/ha) where from increases farmer net income/ha & increases B:C of crop. Demonstrate Chickpea variety JG-14 performs well in drought & hotter conditions as well as compare to farmer cultivated local Desi cultivars. Variety JG-14 produce higher yield in 2017-18 (1390 kg/ha) and 2019-20 (1435 kg/ha) whilst farmer cultivated variety produce lower yield in 2017-18 (1121 kg/ha) and 2019-20 (1210 kg/ha) where from increases farmer net income/ha & increases B:C of crop. Details of crop yields of various crops are described below.

Conclusion

The need for stress, heat tolerant varieties has become paramount in the present context of climate change apart from various adaptation and mitigation strategies to feed the ever increasing population in the country. Concerted efforts of the National Agricultural Research System (NARS) during the last decades resulted in development of stress tolerant varieties in several crops and efforts are further being strengthened to develop varieties tolerant to various stresses individually as well as those with multiple stress tolerance. These stress tolerant cultivars can play an important role in coping with climate variability as well as enhancing the productivity. Location specific conservation techniques, water harvesting and efficient management of water resources and other adaptation strategies as well as enabling policies on crop insurance, along with robust early warning system and weather –based advisories will further facilitate enhancing the resilience of Indian agriculture to climate change and climate variability.

Consolidated Results: (Soybean) (Number of farmers involved year wise: 2017, 2018, 2019

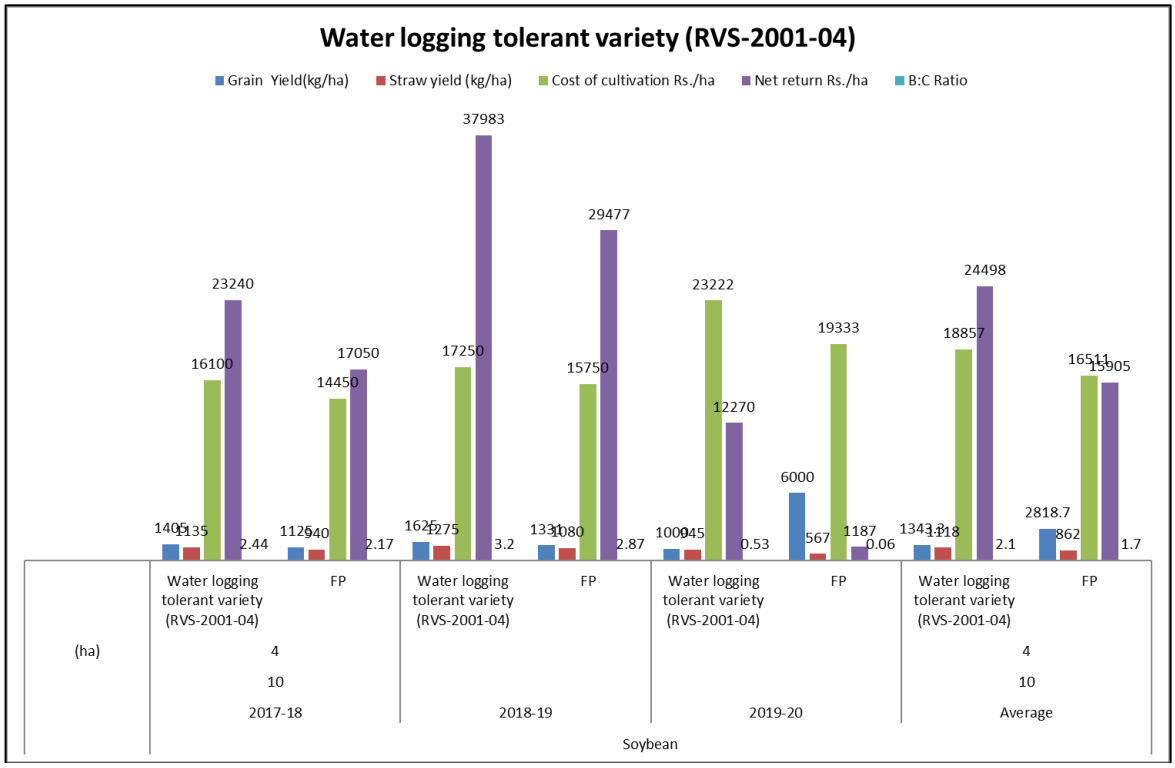
Crop	Year	Number of farmers	Area covered (ha)	Interventions	Grain Yield(kg/ha)	Straw yield (kg/ha)	Cost of cultivation Rs./ha	Net return Rs./ha	B:C Ratio
Soybean	2017-18	10.0	4.0	Water logging tolerant variety (RVS-2001-04	1405	1135	16100	23240	2.44
				FP	1125	940	14450	17050	2.17
	2018-19			Water logging tolerant variety (RVS-2001-04	1625	1275	17250	37983	3.20
				FP	1331	1080	15750	29477	2.87
	2019-20			Water logging tolerant variety (RVS-2001-04)	1000	945	23222	12270	0.53
				FP	600	567	19333	1187	0.06
	Average	10.0	4.0	Water logging tolerant variety (RVS-2001-04)	1343.3	1118	18857	24498	2.1
				FP	2818.7	862	16511	15905	1.7

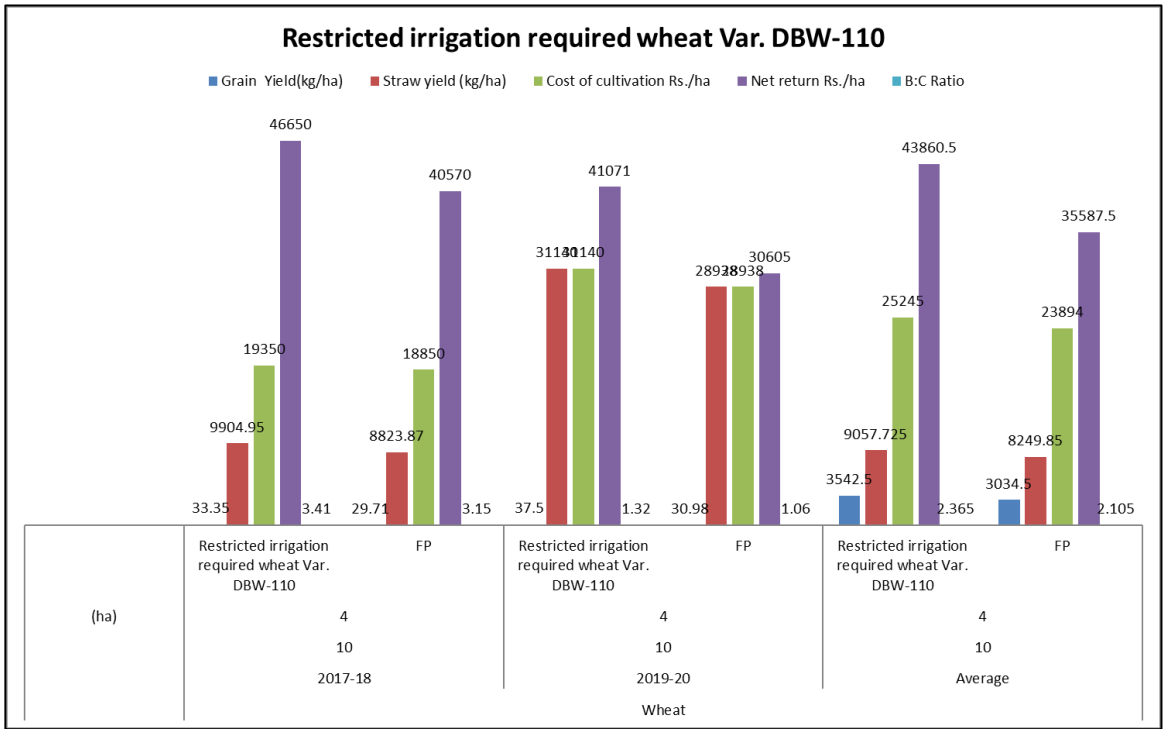
Consolidated Results: (Wheat) (Number of farmers involved year wise: 2017 & 2019

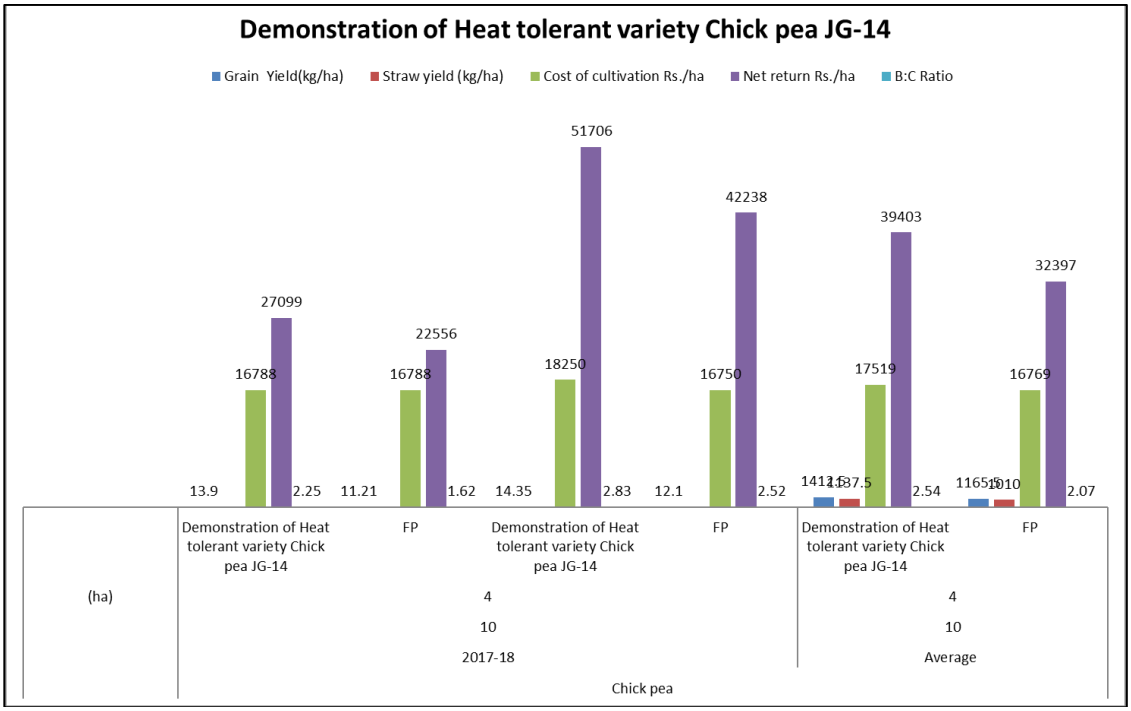
Crop	Year	Number of farmers	Area covered (ha)	Interventions	Grain Yield(kg/ha)	Straw yield (kg/ha)	Cost of cultivation Rs./ha	Net return Rs./ha	B:C Ratio
Wheat	2017-18	10	4.0	Restricted irrigation required wheat Var. DBW-110	3335	9904.95	19350	46650	3.41
				FP	2971	8823.87	18850	40570	3.15
	2019-20	10	4.0	Restricted irrigation required wheat Var. DBW-110	3750	31140	31140	41071	1.32
				FP	3098	28938	28938	30605	1.06
	Average	10.0	4.0	Restricted irrigation required wheat Var. DBW-110	3542.5	9057.725	25245	43860.5	2.365
				FP	3034.5	8249.85	23894	35587.5	2.105

Consolidated Results: (Chickpea) (Number of farmers involved year wise: 2018& 2019

Crop	Year	Number of farmers	Area covered (ha)	Interventions	Grain Yield(kg/ha)	Straw yield (kg/ha)	Cost of cultivation Rs./ha	Net return Rs./ha	B:C Ratio
Chick pea	2017-18	10	4.0	Demonstration of Heat tolerant variety Chick pea JG-14	1390		16788	27099	2.25
				FP	1121		16788	22556	1.62
	2019-20	10	4.0	Demonstration of Heat tolerant variety Chick pea JG-14	1435		18250	51706	2.83
				FP	1210		16750	42238	2.52
	Average	10.0	4.0	Demonstration of Heat tolerant variety Chick pea JG-14	1412.5	1137.5	17519	39403	2.54
				FP	1165.5	1010	16769	32397	2.07







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