Journal of Pharmacognosy and Phytochemistry

Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 3210-3212

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Impact of climate resilient varieties on crop productivity in NICRA village

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Abstract
India is more vulnerable in view of the high population depending on agriculture, excessive pressure on natural resources and poor coping mechanisms. In India, significant negative impact have been implied with medium-term (2010-2039) climate change, predicted to reduce yield by 4.5 to 9 per cent, which is roughly up to 1.5 per cent of GDP per year (Venkateswarlu *et al*., 2013). 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, Jalna during 2015-16 and 2016-17 in NICRA village which shows 75.23 per cent yield increase in Pigeon pea due to introduction of short duration variety BDN-711 under protective irrigation. Improved variety of Soybean MAUS-71 given higher yield of 15 per cent over traditional practice with use of BBF technology. The heat tolerant wheat variety Netravati (NIAW-1415) in Rabi season contributed 27 per cent higher yield over local check variety Lok-1. Rabi Sorghum variety Parbhani Moti and Digvijay variety of Bengal Gram contributed 91 per cent and 30 per cent yield increase respectively. (Annual Progress Report, 2016-17). This paper aims to document impact of climate resilient varieties and suggest strategy for up-scaling and out-scaling of these technologies.

Keywords: Impact, climate change, resilient, agriculture, rainfed.

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. Under the technology demonstrations component (TDC) of NICRA project, an integrated package of proven technologies would be demonstrated in Kadegaon village of Badnapur Tahsil of Jalna 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, rice and maize will decrease while it could be neutral or positive with groundnut, soybean and chickpea (Aggarwal, 2008).

Material and Methods
The development and identification of climate resilient crop varieties, with enhanced tolerance to heat, drought, flooding 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 (Maheshwari *et al*., 2012).

Table 1: Improved Crop Varieties used for cultivation in nicra Village Kadegaon

Sr. no.	Crop	Variety	Remarks
1	Pigeon pea	BDN-711	Short duration Suitable for Rainfed Situation.
2	Soybean	MAUS-71	Non-shattering and high yielding variety cultivated on Broad Bed Furrow (BBF).
3	Wheat	Netravati (NIAW-1415)	Heat tolerant and low water requiring var. suitable to grow in high temperature.
4	Rabi Sorghum	Parbhani Moti	Suitable for rainfed situation in Rabi season.
5	Bengal Gram	Digvijay	Suitable both on rainfed and irrigated condition.

Results and Discussion

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. Details of crop yields of various crops are described below.

Details about individual interventions demonstrated

Technology demonstrated and details of the practice	**Pigeon pea(Micro irrigation (Drip/sprinkler etc) (**Use of low cost drip irrigation system with Fertigation)
Farmer's practice	Protective irrigation by conventional method
Year of start	**2016**

Consolidated Results- Pigeon Pea (Number of farmers involved year wise: 2016 (05)

Treatment	Crop	Variety	Seed yield (Kg/ha)	Fodder yield (Kg/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Improved practice	Pigeon Pea	BDN-711	3410	1860	146630	95005	2.84
Farmer's practice		Local var. Khadki	1050	2640	45150	16025	1.55

*****Market price of red gram: Rs. 4300/q

Consolidated Results- (Soybean) (Number of farmers involved year wise: 2016 (10), 2017 (10)

Treatment	Crop	Variety	Seed yield (Kg/ha)	Fodder yield (Kg/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C ratio
Improved practice	Soybean	MAUS-71 (BBF)	1585	2380	42002.5	14250.5	1.51
Farmer' s practice	Soybean	JS-335	1375	2290	36437.5	9512.5	1.35

Consolidated Results- Wheat (Number of farmers involved year wise: 2015 (-), 2016 (15)

Comparison of Treatments	Crop	Variety	Seed yield (kg/ha)**	Fodder yield (kg/ha)**	Gross returns (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
Improved Practice	Wheat	Netravati (NIAW-1415)	2625	NA	42000	18300	1.77
Farmers practice	Wheat	Lok-1	2062	NA	33000	8500	1.34

Consolidated Results- Rabi Sorghum Number of farmers involved year wise: 2015 (50), 2016 (20)

Comparison of Treatments	Crop	Variety	Seed yield (kg/ha)**	Fodder yield (kg/ha)**	Gross returns (Rs./ha)	Net returns (Rs./ha)	B:C ratio
Improved Practice	Rabi sorghum	PBN-Moti	20.8	6500	56940	38040	3.01
Farmers practice	Rabi sorghum	M-35-1	10.5	4800	33300	14700	1.79

Consolidated Results- Bengal gram Number of farmers involved year wise: 2015 (10), 2016 (10)

Comparison of Treatments	Crop	Variety	Seed yield (kg/ha)**	Fodder yield (kg/ha)**	Gross returns (Rs./ha)	Net returns (Rs./ha)	Benefit cost ratio
Improved Practice	Bengal gram	Digvijay	1426	680	69075	47235	3.16
Farmers practice	Bengal gram	Vijay	1090	450	47250	28490	2.51

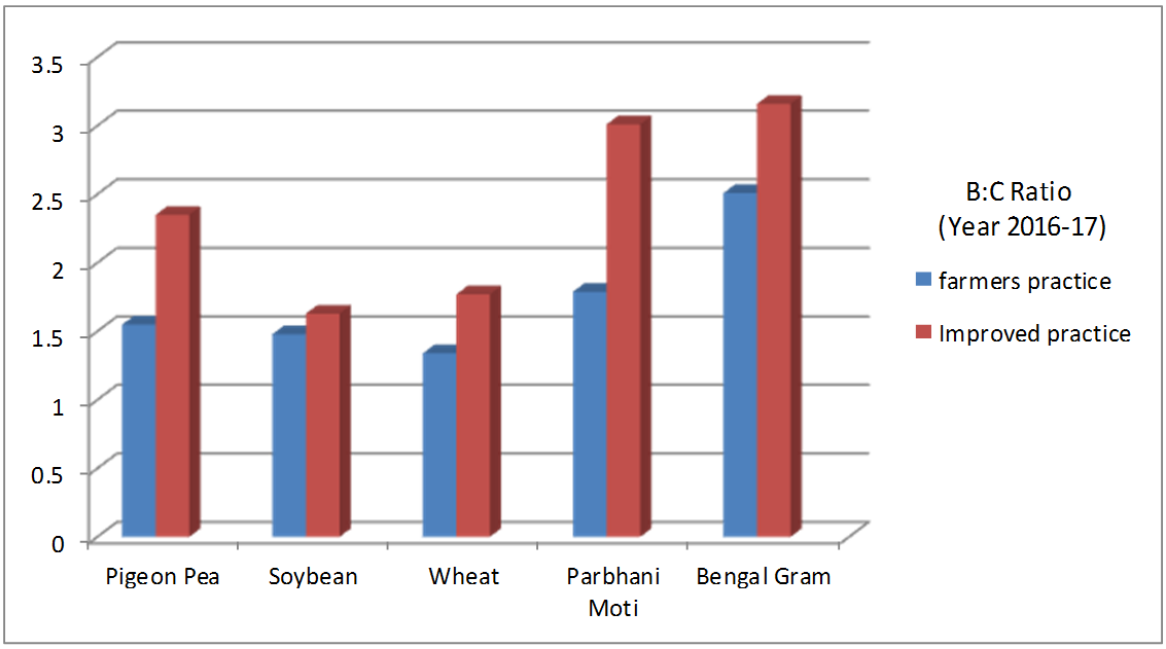

Fig 1: Graphical representation of Impact of Climate Resilient Varieties on Crop Productivity in NICRA Village

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.

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