

Enhance the cropping intensity through crop diversification

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Under erratic climatic situations, the cropping intensity can be increased from existing 155 to 200–300% in the farmer's field by the adoption of a new cropping pattern (Torina and Muskmelon) with a short duration variety and less water requirement crops along with advanced production techniques in the place of traditional cropping pattern. In this situation, KVK Chhatarpur has introduced short duration variety of Toria (RVT1) which is sown after the harvest or failure of kharif (summer) crop and muskmelon variety (Hara Madhu) which is sown after the harvest of Toria crop. It increases the cropping intensity which would lead to increase in the production of oil seeds and fruits under the deficit moisture condition. Temporary raised and sunken beds are the new techniques for growing muskmelon during the zaid season for enhancing the production and productivity per unit area by less consumption of water. Therefore, this system generates additional income for farmers by maximizing the production per unit area and, utilizing the vacant space.

Keywords: B:C ratio, Toria, Yield

BUNDELKHAND, a semi-arid region in central India is characterized by the poor human development indicators and degraded status of natural resources. Besides these, agriculture is the mainstay of the bundelkhand economy with 90% of population being dependent on agriculture, that is about 75% rainfed and 25% irrigated situation. Chhatarpur district is basically known for rainfed farming where an average annual rainfall ranges 750–1150 mm/year. Beside these early or late onset of monsoon, either sudden downpour of rainfall or long dry spell occurs in each year due to erratic rainfall, hence, there is minimum net sown area in *kharif* season (382800 ha) than *rabi* season (473800 ha) out of 549080 ha net sown area of Chhatarpur district of Madhya Pradesh. Therefore, the cropping intensity (156%) is very poor, because farmers could not fulfill the requirement of their own increase in the productivity of crops/

area by the increase net sown area, improving the existing cropping pattern through incorporation of short duration crops, viz. toria and hybrid muskmelon in place of groundnut-wheat based cropping system.

In this regards KVK, Chhatarpur scientists introduced short duration

toria variety RVT 1 and muskmelon variety Hara Madhu to increase the cropping intensity by changing the cropping pattern. Additional yield could be obtained from this area by adopting new short duration cropping system to increase 100% yield per unit area by manipulating the limited land resources. Toria and



Flowering and siliqua stage of Toria

Table 1. Yield and economics of toria and muskmelon

Variety	Siliqua and fruits/plants	Grains/Siliqua	Yield g/m ² and per plant	Yield q/ha	COC	GR	NR	B:C ratio
Toria-RVT1	155	7	63	6.25	14500	31562	17062	2.2
Muskmelon-Hara Madhu	8.5	-	2.15 kg/m ²	215	75000	21500	200000	3.7
Farmers practice-blackgram/PU 31	15.5	9	49	4.9	17800	24750	6950	1.4

muskmelon are suitable for *kharif* harvested area or *kharif* failure or fallow areas to fulfill the vacant time/space and basic need of farmers, because this system will generate employment and additional income for farmers by maximizing the production/unit area by utilizing of vacant areas. The suitable sowing time of toria and muskmelon is mid week of september–last week of September and first week of February respectively and their harvesting time is first week of February and last week of May respectively. KVK Chhatarpur demonstrated improved variety of Toria and Muskmelon as a contingent crop in farmer's field during *kharif* 2021–22 and *zaid* 2021–22. That crop failed in all situations due to lack of moisture, proper field preparation and heavy infestation of weeds and insects in that area. Therefore 40–45% area was fallow of Chhatarpur district during *kharif* 2021. In this situation, toria was a good alternative crop of *kharif* fallow area and Muskmelon was an important vegetable crop in summer often grown in drought-prone regions. Due to their lower water requirement (100–240 mm), they fits well in the rainfed cropping system or *kharif* failure area. This would increase the cropping intensity of the



Maturity stage of toria

area which would certainly enhance the income of farmers by adopting improved production techniques with improved variety of both crops.

A 6.25 q/ha and 215 q/ha yields were obtained on farmer's fields of both crops during 2021–22 which was a 28.5% and 45.5% increase over farmers practice. This was due to more no. of primary branches/plant, no. of secondary branches/plant, no. of siliqua and fruits/plant, siliqual length and fruits diameter, which, ultimately gives high seed and fruit yield. Maximum net monetary return and benefit cost (B:C) ratio was recorded in this cropping system (₹217062/ha and 2.95) as compared to farmers traditional practice (₹6950 and 1.4) (Table 1). Also, this combination was found better than traditional farmer's practices.

Water management

Normally, no irrigation is required in the toria as it is sown on residual soil moisture and receives 1–2 showers during november month. However in case of moisture stress, irrigation at flowering stage is required to obtain desired yield, because flowering and siliqua formation stages are critical for irrigation in toria. Besides this, supply of irrigation water between furrows as per need of muskmelon is required, because their water requirement is very low. Therefore, site specific moisture is supply in furrows, as they helped plants to recover fully and maintain their quality especially sugar content and also yield as compared to flood irrigation.

Performance of RVT1

Toria variety RVT 1 (Raj Vijay

toria 1) has been developed from JT-IXT9. Morphologically their plants are erect and sprucing in nature and matured in 98–105 days and had more number of primary and secondary branches and more number of seeds in siliqua than check. By virtue of its short duration and low or high temperature tolerance during germination and seedling stages, it is grown as a catch crop.

Performance of Hara Madhu

Fruit are of good size and preferred fragrance, less thickness, takes 75 days to mature and suitable for local and distant marketing.

Suitable package and practices

KVK Chhatarpur introduced the improved production technologies of toria and muskmelon crops. Use of 75% recommended dose of fertilizers (N: P: K 80:60:40 kg/ha and 200:100:100 kg/ha), basal application of phosphorus and potash and 2 equally split application of nitrogen has been found useful for both crops. Toria should be sown in mid to last week of September. Generally, toria and muskmelon is planted between rows to plant 30 cm × 15 cm and 2.1 cm × 0.40 cm respectively and thinning is done 3 weeks after sowing in toria to maintain plant population and plant to plant distance. Line sowing with a seed drill, the treatment of seeds with systemic fungicide (carboxin + thiram @2 g/kg seed) and specific bacterial association for nitrogen fixation in toria with the bacterium *Azotobactor* and soil application of PSB and KSB @5 kg/ha along with 75% recommended dose of fertilizers was done. Toria and muskmelon are a good substitute for *kharif* failure or fallow areas. In this situation these crops, growing in the second week of September and the second week of February are necessary for optimum production. At this time rhizospheric bacteria (PSB and KSB) are able to secrete different types of organic acid that consequently solubilize the bound forms of phosphate and potassium. There is a need to develop a suitable agricultural system which requires



Fruit picking stage of muskmelon

lower fertilizer input with higher fertilizer use efficiency. Therefore, the current trend needs to explore the possibility of supplementing chemical fertilizers with organic ones, more particularly bio fertilizers.

Impact of technology

The adoption of an improved variety of toria (RVT 1) and muskmelon (Hara Madhu) contributed to raising the cropping intensity and income level of the farmer, which brought out positive socio-economic changes in their life. Farmers have inspired the other farming community especially marginal farmers in the village (singrawankala) and adjoining

village (manpura) to adopt this cropping system with advanced production technology. The horizontal spread of this technology has very fast in a 20 farmers of 20 acre area in farming community. It could be possible mainly due to effective dissemination of improved variety and production technique of toria and muskmelon crop by bringing awareness among farmers and farm women along with RAEO of the district through various field-oriented activities, training programs, and availability of literature related to package and practices of toria and muskmelon crop.

Feedback from toria and muskmelon growers

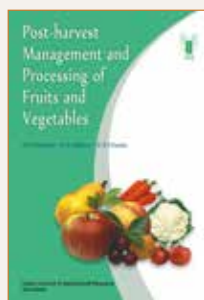
Adoption of a given variety (RVT 1 and Hara Madhu) is usually a process, which passes through awareness and assessment of the expected returns from the variety. Good performance of the variety was observed during the evaluation with the farmers. For getting feedback about the variety, farmers were interviewed through group meeting in the study area. The farmers decided to switch off the other variety and adoption of these improved variety and their production techniques.

SUMMARY

Climate change negatively affects the *kharif* crop ecosystems especially high temperature and erratic rainfall increases during the growing season which is known to be a particularly more vulnerable stage to climate variability. In this situation, Krishi Vigyan Kendra Chhatarpur introduced short duration crops Toria and Muskmelon and their improved variety RVT1 and Hara Madhu respectively after the harvest of *kharif* crop or failure crop, in the area to increase the cropping intensity by changing the cropping pattern and additional yield could be obtained from this area manipulating the limited land resources. Toria is suitable for *kharif* harvested areas or *kharif* failure area to fulfill the vacant time or space and basic needs of farmers. Muskmelon is also a less water-required crop beneficial for rainfed areas. This system can increase the frequency of harvests each year, resulting in increased food supplies through maximum utilization of all available resources land, sunlight residue moisture and nutrients without additional crop land expansion.

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