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Kallingada [*Citrullus lanatus* (Thumb) Mansf.] Potential Future Crop for Enhancement of Rajasthan Farmer's Income under Arid Zone

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Citrullus lanatus belong to family cucurbitaceae is a native crop of Africa, it has been introduced in to India during tenth or eleventh century (Tindall, 1983). Cucurbitaceae family consists of about 90 genera and 750 species from which eight genera are most commonly cultivated. Among *Citrullus lanatus*, the Kallingada [*Citrullus lanatus* (Thumb) Mansf.] or seed purpose watermelon has been cultivated in Indian *Thar* desert since many years as intercrop with pearl millet, castor, green gram, cluster bean and sorghum in Gujarat and Rajasthan (Jodhpur, Jaisalmer, Bikaner and Sikar). The crop can be grown mainly during *kharif* season. It is particularly grown in hot and dry situation under ordinary soil. But, it thrives well in deep, rich, well-drained sandy loam soil. It is extremely drought hardy can tolerate high temperature but susceptible to disease during high rainfall. The immature fruit is consumed as vegetable and the rind is utilized for product such as pickles and preserves, as well as for extraction of pectin. Its mature fruit is consumed as dessert and for seed extraction. In Rajasthan, kallingada is grown an area of 2643 hectares with production of 13306 metric tonnes. The seed kernels locally called as *Magaj* have been largely used in confectionary and pharmaceuticals industry and in restaurants/ hotels as a source of flavour and thickeners in vegetable preparations. Roasted seeds are generally consumed as snacks and supposed to regulate blood sugar levels, increase energy, maintain the nervous system and promote healthy skin.

All India Coordinated Research Project on under utilized crop was initiated during 1982 by ICAR. The Project was later re-named as AICRP on Underutilized Crops and recently rechristened as AICRN on Potential Crops. Total 50 accessions of Kallingda were evaluated at ICAR-NBPGR Regional Station Jodhpur during 2021-22 under ABD experimental design in 7 blocks and the agro-morphological characters were recorded as per the minimal Descriptors . The trait specific promising germplasm accessions were identified which are mentioned below in table 3:

Table1 : Nutritional value of kallingada

Sr. No.	Nutrient	Value/ 100g
1	Carbohydrates	18-24%
2	Crude protein	19-26%
3	Crude fibre	19-30%
4	Crude Fat	24-29%
5	Ca	8-21mg/100gm
6	Fe	12-33 mg/100gm
7	Copper	0.1-2.3 mg/100gm

Source: Jhadav *et al.* 2017

Soil : it can be grown various type of soil however**,** soil having pH range 5.5-7.5 is found favorable but it's should be grown in well drained soil preferably in sandy soil. Its cultivation not advocated where the soil which are acidic in nature and water table is high

Climate

It requires warm and dry climate for successful cultivation. Its flowering occurs after 6 to 7 week of sowing and fruit development takes place just after the fruit set. Areas having high humidity during fruit formation stage and more rainfall particularly at maturity are not suitable for its cultivation.

Field preparation

It is always desirable for obtaining Kharif crop deep ploughing during the month of June followed by two cross harrowing before sowing. Well rotten 10 tons of farm yard manure is should with well mixed during ploughing. 80 kg nitrogen and 60 kg phosphorus should be applied at the time of sowing. Rest fertilizer application can be done after soil analysis.

Varieties: AICRN on Potential Crops under aegis of ICAR is working to develop the varities of this crop. Some the latest vairties of importance are placed below:

Table 2 Salient features of improved verities of kallingada

Sr. No.	Variety	Institute developed	Maturity days	Yield (q/ha)	Distinguish character
1.	Gujarat Kalingada-1,	SDAU, Gujarat	75-90	70-80	Fruits are round in shape and oil content in seed is higher (35%)
2.	GK-2,	SDAU, Gujarat	75-80	70-75	It was released during 2020 by SDAU, Gujarat. oil content in seed is higher (39%)
3.	CAZRI Kalingaad13-2	CAZRI, Jodhpur	90-95-	125-150	It was developed by CAZRI, Jodhpur During 2018.Fruit are long in shape with seed yield of 4-5 quintal/Hec.
4.	GK-3	SDAU, Gujarat			It was released during 2024 by SDAU

Time of sowing: Generally kallingada sown during the period of July to August depend upon arrival of monsoon in western Rajasthan. The late sowing after mid July found beneficial to avoid attack of Downey mildew disease which is very serious biotic stress in arid and semi arid region.

Seed rate : 1-2 kg depend upon soil type and cropping system.

Insect-pest and Diseases

Powdery mildew: This is very serious disease of kallingada appear white or grey spots are appear on leaves and stem and later on white powder covers the whole plant in severe attack of fungus and ultimately all leaves drop The fruits remain smaller in size with less seeds yield and cause severe yield loss. To control this fungal disease field should be kept clean and affected plants should be burnt immediately. Spray of karathane (0.1%) should be done at the interval of 15 days.

Downy mildew: At initial stage, angular spots are observed on upper surface of leaves which spread rapidly on lower surface also in case of severe incidence. High relative humidity and high temperature are very congenial for development of this fungal disease. For protection, seeds should be treated with fungicide before sowing. Spray of broad-spectrum systemic fungicide like carbendazim (0.25%) should applied for control of disease.

Fruit Harvesting and Seed Extraction

The maturity of fruit on a vine can be judged by color change from fruit and leaves color changes. Fruit are harvested from 70-95 days after sowing depend upon variety. Seed can be

extracted from the fruit manually followed by drying for reducing moisture content to prevent from attack of fungus and other spoilage.

Fig1 Field view of experiment

Evaluation of kallingada germplasm

Analysis of variance for agro-morphological characters showed significant differences among the quantative and qualitative parameters indicating existence of wide variability. Data were recorded Days to 50 % flower, plant yield, , No. of seeds/fruit and 1000 seeds weight(gm). The promising accessions identified for late maturity and potential to biotic stress tolerance (Downey mildew)

Table.3 Range of variation of kallingada germplasm for morphological traits.

Character	Range	
	Min	Max
Days of fruit initiation	38	49
Days to maturity	74	95
Fruit diameter(cm)	9	12.8
Fruit yield (Kg/plant)	2.0	6.14

No. of fruits/plant	8	12
Seed yield (g/plant)	8	70
100 seed weight(g)	4.43	7.7

Future prospects

The seed of kallingada has high potential for export due to richness for protein and oil content. Therefore it is necessary that more emphasis has to be given for collection of diversity with wild relatives for identify the source of yield enhancement particularly for seed yield and resistance to mildew disease in Rajasthan.