PROJECT INFORMATION

“Genetic improvement of major vegetable crops for Western Coastal Plains of India”

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Title of the Project

“Genetic improvement of major vegetable crops for Western Coastal Plains of India”

Funding Agency

In house project

Total Outlay

35 L.

Duration

5 years

Single / Multi-Institutional

Single

Principal Investigator

Dr. Raghunandan K.

Co-Investigators

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Rationale

The West Coast region of India, characterized by undulating topography and sloping lands, poses unique challenges for sustainable agricultural practices. Traditional farming methods in this region often result in soil erosion, nutrient depletion, and reduced agricultural productivity. Goa's agriculture depends largely on vegetable crops, which offer both nutritional security and economic viability. Despite having a sizable area dedicated to vegetable cultivation, Goa remains depends on imports to meet its need, despite the fact that its agroclimatic conditions are ideal for a variety of tropical vegetables. Through research, technology transfer, and farmer training, ICAR-CCARI (Indian Council of Agricultural Research-Central Coastal Agricultural Research Institute) is instrumental in advancing vegetable output. According to the most recent data from the state government, the state's production of indigenous fruits and vegetables reached a peak in 2023–2024, marking a favourable trend for Swayampurna, or self-sufficient Goa, in horticulture. Goa still has a long way to go before it can produce enough fruits and vegetables on its own, even with the rise in output. Vegetable cultivation can be a profitable venture for farmers, especially with the high demand in Goa, particularly during peak tourist seasons. Vegetables are crucial for providing essential vitamins and minerals, contributing to the nutritional well-being of the population. They are an integral part of a balanced diet, complementing staple crops like rice. CCARI recognizes the potential of indigenous vegetables and is working towards their wider adoption, contributing to biodiversity and resilience Brinjal, Tomato, Lady's finger Knoll-khol, Carrot, Beet, Chilli, Spinach, Cucurbits, and Amaranthus are the major vegetable crops grown in the western coastal plains of India. The local vegetable cultivars cultivated in goa are generally low yielding and disease susceptible. Improving the local cultivars for yield and disease resistance will result in higher productivity and production. In this context, the major vegetables crops such as Brinjal, Chilli and Okra will be focused for genetic improvement of yield and disease resistance.

Research Gaps

Five Major Research Gaps in Vegetable Breeding for the Western Coastal Region of India Climate-Resilient Varieties Lack of cultivars tolerant to heat, high humidity, waterlogging, salinity, and erratic rainfall. Resistance to Major Biotic Stresses Limited breeding for resistance to bacterial wilt, begomoviruses, Phytophthora, nematodes, fruit fly, and thrips. Utilization of Indigenous Germplasm Poor collection, characterization, and use of local landraces and wild relatives in breeding programs. Breeding for Coastal Soil Constraints Insufficient focus on salinity tolerance, acid-soil adaptation, and nutrient-use efficiency. Quality and Market-Oriented Breeding Limited emphasis on nutritional quality, shelf life, processing traits, and consumer-preferred characteristics alongside high yield.

Objectives

i. Collection and conservation of germplasm lines of Brinjal, Chilli and Okra from west coast region of India. ii. Screening of germplasm lines for major biotic stresses iii. Genetic studies of the traits responsible for disease resistance iv. Breeding and development of high yielding multiple stress tolerant varieties for major biotic stresses and fruit quality.

Activities

Objective 1. Collection and conservation of germplasm lines of Brinjal, Chilli and Okra from western coastal plains of India. Activities: • Conduct germplasm exploration and collection surveys. • Establish and conserve collected accessions. • Develop a germplasm database and identify promising donors. Objective 2: Screening and evaluation of germplasm for resistance to major biotic stresses Activities: • Screen germplasm under field and controlled conditions. • Evaluate resistance to major diseases and insect pests. • Identify stable resistant sources across seasons and locations. Objective 3: Genetic analysis of disease resistance and other key agronomic traits using conventional and molecular approaches Activities: • Develop segregating populations through strategic crosses. • Study inheritance of resistance and yield-related traits. • Identify molecular markers/QTLs associated with resistance traits. Objective 4: Development of high-yielding, multiple biotic stress-tolerant varieties with superior fruit quality through targeted breeding Activities: • Hybridize elite and resistant parents. • Advance breeding populations through selection. • Evaluate promising lines for yield, stress tolerance, and fruit quality. • Conduct multi-location trials and identify superior varieties for release.

Treatment Details

Treatment Details Pathogen Ralstonia solanacearum virulent isolate Seedling age 25–30-day-old healthy seedlings Inoculum concentration 10■ CFU mL■¹ (OD■■■ ≈ 0.3–0.5) Inoculation method Root-dip (5–10 min) or soil drench (20–30 mL/plant) after slight root injury Experimental design Randomized Complete Block Design (RCBD) with 2–3 replications Plants per genotype 10–15 plants per replication Disease observation Record wilt symptoms at 7-day intervals up to 30 days after inoculation Disease assessment Percent Wilt Incidence (PWI) = (Wilted plants/Total plants) × 100 Disease reaction Resistant (0–20%), Moderately Resistant (21–40%), Moderately Susceptible (41–60%), Susceptible (61–80%), Highly Susceptible (>80%). Field level screening is done in hot spots.

Fertilizer Doses

POP followed as per the published POP of ICAR-CCARI, Goa.

Variety

Germplasm lines and breeding lines.

Replications

3.0

Observations to be Recorded

General observations recorded in vegetables for breeding and germplasm evaluation • Germination and plant establishment (%) • Plant vigour and growth habit • Days to 50% flowering • Plant height (cm) • Number of primary branches per plant • Days to first harvest and crop duration • Fruit/pod characteristics (shape, size, colour, weight) • Number of fruits/pods per plant • Average fruit/pod weight (g) • Marketable and total yield per plant/plot • Resistance/tolerance to major pests and diseases • Tolerance to abiotic stresses (heat, drought, salinity, etc.) • Quality traits (TSS, pungency, firmness, dry matter, nutritional quality) • Seed traits (seed size, 100-seed weight, seed yield) • Distinctness, Uniformity and Stability (DUS) descriptors These are the standard observations recorded in vegetable breeding and germplasm evaluation across crops such as brinjal, chilli, okra, tomato, cucurbits, and other vegetables.

GPS Coordinates of Field (Lat , Long)

ICAR-CCARI Farm (Varies if the trial is taken up in farmers field)

Expected Output

Conservation of germplasm lines, local varieties and landraces Identification of germplasm lines with desirable disease resistance traits and fruit quality Identification and development of high yielding multiple stress tolerant varieties for major biotic stresses and fruit quality.

Expected Outcome

Increased productivity and production of major vegetable crops in the west coast region of India

When the field was developed

2025.0

What are crops being cultivated season-wise

Rice and Vegetables

Soil type

Clay loamy.

Soil pH, EC, OC

pH-5.8, EC-0.002

Soil depth

25-30 cms

Soil NPK and Micronutrient status

N-125-130 kh/ha, P- 10-15 Kg/ha, K-145-160 Kg/ha.

Common pests and diseases

Diseases: 1. Bacterial Wilt Pests: 1. Sucking Pests 2. fruit and Shoot borer