Globalization of India's Crop Improvement Research

Yashwant Rao Chavan Academy of Development Administration , Pune, 19-21 January 2023

Experiences in Quality Vegetable Seed Production for Export

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Indo American Hybrid Seeds(India) Pvt. Ltd

Global Seed Market

Seed exports from India are less than ₹1,000 crore per annum which accounts less than one percent of annual global seed trade of $14 billion.

India definitely has a potential to capture a 10 per cent share which is $1.4 billion or ₹10,000 crore by 2028 (Business line July 23, 2020).

India – A potential seed production hub

India is an ideal location to produce high value hand pollinated vegetable and flower seeds for the below reasons.

-Varied climatic zones.

-Skilled work force.

-Established Seed villages with decades of training and capacity building.

-Well established seed quality management systems.

-Good infrastructure.

To exploit this opportunity, one of the challenges is to produce disease free quality seeds to meet the international seed standards.

With proper agronomic practices and quality management system it is possible to meet the required quality in terms of germination, vigour, genetic purity and seed health.

Quality seed

Seed is the repository of the genetic potential of crop species and their varieties resulting from the continuous improvement and selection over time.

Quality seed can be defined as varietally pure with a high germination percentage, free from diseases and disease organisms, with a proper moisture content and weight.

Quality seed production which follows efficient certification procedures plays a major role and is important to get good crop, maximum productivity and disease free products .

Characteristics of Quality seed

1.Seed Health: Seeds should be devoid of insect damage and free from any microbial infection. It refers to the diseases specified for the seed certification which may cause contamination of seed lot. Ex: Tobamo in Tomato and CMV in Cucurbits which may cause yield loss up to 25-50%.

2. Physiological Attributes: Seeds with good germination capacity and seed vigor are considered as quality seeds.

a) **Seed Germination:** Germination capacity of a seed refers to the capacity of the seeds to sprout and produce all parts of a healthy seedling and grow. A germination rate of above 98% is an indication of high seed viability.

a) **Seed Vigor:** Seed vigor is the sum total of all the seed attributes that favors rapid and uniform standard establishment in the field under varying field conditions.

Characteristics of Quality seed

3.Physical Purity: Thee seeds should be of uniform size and shape without any damage. It should be devoid of inert matter like dust, stones, seeds of other crop varieties, broken seeds, weed seeds, etc.

4.Genetic purity: Genetic purity of the seed should be maintained in order to ensure the quality of the seeds. It is essential to maintain 100% purity in case of Breeder/nucleus seed and >99.5% in case of foundation seeds.

5.Moisture Content of Seeds : Seeds with high moisture content will loose its germination vigour and viability soon. It is also essential to protect the seeds from pest infestation and attack by diseases. Seeds should be stored at a safe moisture level of 6 – 10% depending on the crop.

Factors influencing quality seed production:

-Climatic requirement
-Selection of land/Substrate production
-Nursery management to get disease free seedling
-Isolation distance
-Season
-Plant Nutrition
-Irrigation
-Field inspection and rouging
-Harvesting and threshing
-Post harvest handling(Drying, Seed treatment and storage).

Potential Infection Sources

Infection Source	Description	Good Practice
Seed	Seed-borne /contaminated pest	Use certify seed, seed treatment before seeding
Air	Fungal spore, insects spread by wind	Produce in disease free area, field inspection, seed and plant test, strict controls measure
Water	Rain splashes, irrigation water	as above
Soil	Bacteria, fungi, nematode stay over seasons as source of inoculums	Substrate production
Mechanical, hand, cloth, equipment	Some viruses are mechanically transmitted.	The information should be "track and traceable"
Pollen	Some viruses and bacteria	
Adjoining fields	As a source of infection	

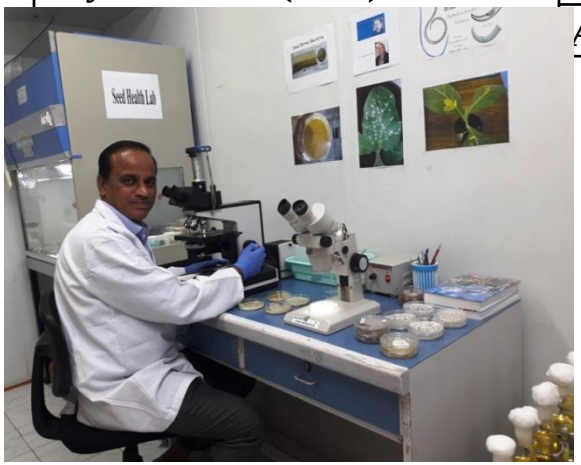
(APSA and ISF, 2020 : Good Practices for Healthy Vegetable Seed Production)

IMPORTANT SEED HEALTH TESTS

Potato Spindle Tuber Viroid (ISF code PSTVd)
Chili Veinal Mottle Virus (ISF code ChiVMV)
Clavibacter michiganensis spp michiganesis (ISF code Cmm)
Columnea Latent Viroid (ISF code CLVd)
Pepino Mosaic Virus (ISF code PepMV)
Pepper Chat Fruit Viroid (ISF code PCFVd)
Tomato Mottle Mosaic Virus (ISF code ToMMV)
Tomato Brown Rugose Fruit Virus (ISF code ToBRFV)
Tomato Chlorosis Virus (ISF code ToCV)
Tomato Planta Macho Viroid (ISF code TPMVd)
Tomato Leaf curl New Dehli Virus (ISF code ToLCNDV)
Tomato Spotted Wilt Virus (ISF code TSWV)
Xanthomonas euvesicatoria (ISF code Xav)
Xanthomonas perforans (ISF code Xav)
Xanthomonas gardneri (ISF code Xav)
Xanthomonas vesicatoria (ISF code Xav)

SEED HEALTH TEST : *Indo- American Hybrid Seeds Pvt. Ltd* Bengaluru

Crop	Pathogen	No. of seeds requirement	No. days required for the test result
Tomato / Pepper	**Tobamoviruses (TMV/ ToMV)**	**3,000**	**5-7 days**
	Xanthomonas axnopodis pv. Vesicatoria	**10,000**	**7-10days**
	***Clavibacter michiganensis* spp.**		
***Brassica* spp. (Cabbage, cauliflower, oil rape, broccoli, calabrese. Canola)**	***Xanthomonas campestris* pv. *Campestris***	**10,000**	**7-10days**
Cucurbits	**Cucumber Green Mottle Mosaic Virus (CGMMV)**	**100**	**3-4 days**
***Oryza sativa* (Rice)**	***Pyricularia oryzae***	**400**	**8-9 days**



Parent seed

- Parent seed is multiplied using secured & hygienic facility
- Parent seed is tested for relevant diseases before planting
- Parent identity & physiological quality is known well before planting

Nursery Care

- Seedlings nursery facility should be clean & disinfected before start of season
- Sowings to be completed in clean/ hygienic conditions
- People engaged in nursery should follow disinfection of hands, feet and also wear protective clothing to avoid diseases & their spread in nursery
- Prophylactic and control measures need to be taken to avoid disease / pest infestation in nursery
- Balanced nutrient and Water management

HEALLTHY SEEDLINGS

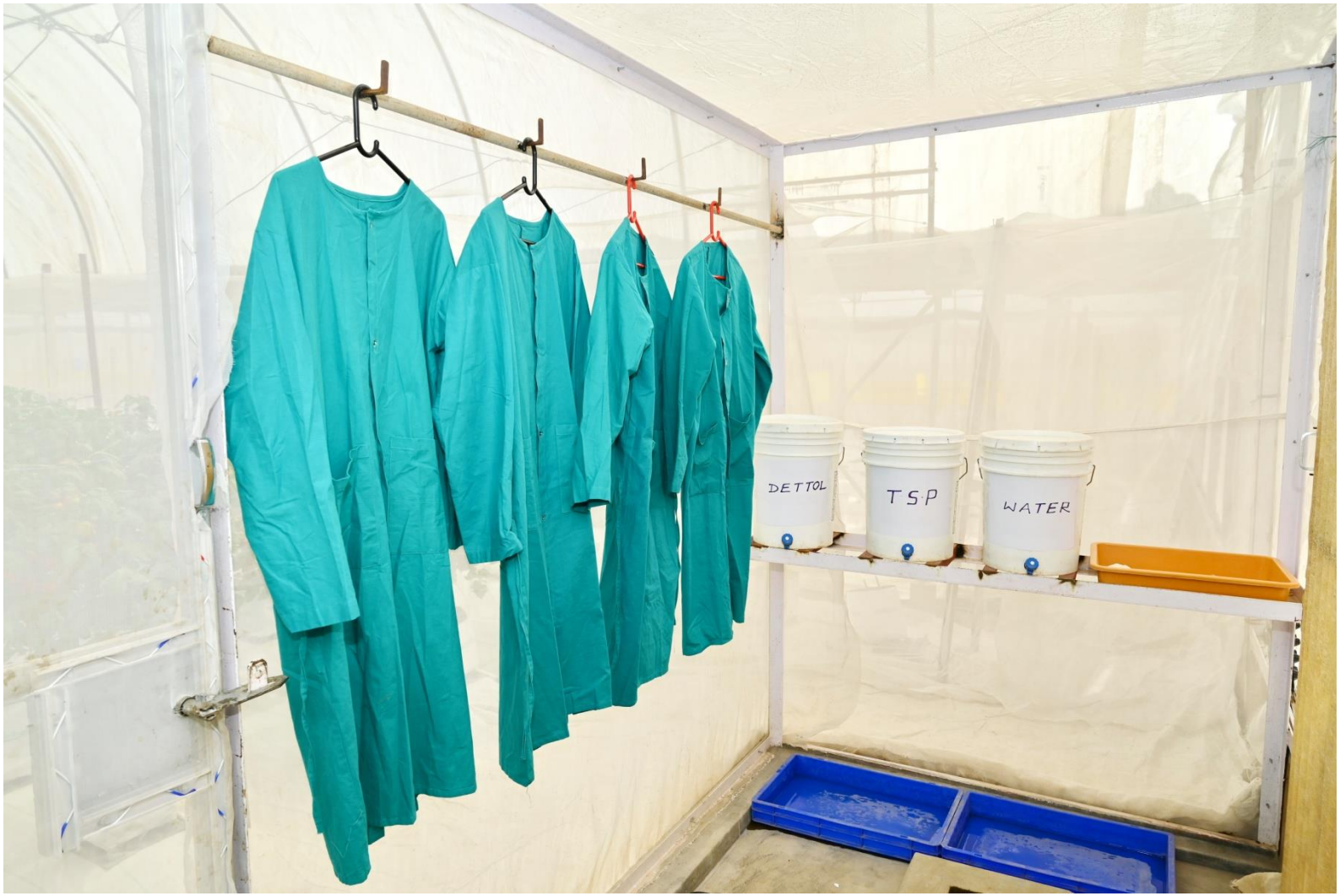
Pre-planting care

- Land selection based on crop requirement
- Look for previous crop history from crop rotation perspective to avoid impact of diseases
- Check for water quality & adequate availability based on crop cycle

MEDIA STEAM STERILIZATION

GREEN HOUSE MAINTENANCE – GROUND DISINFECTION

Production Unit Entry

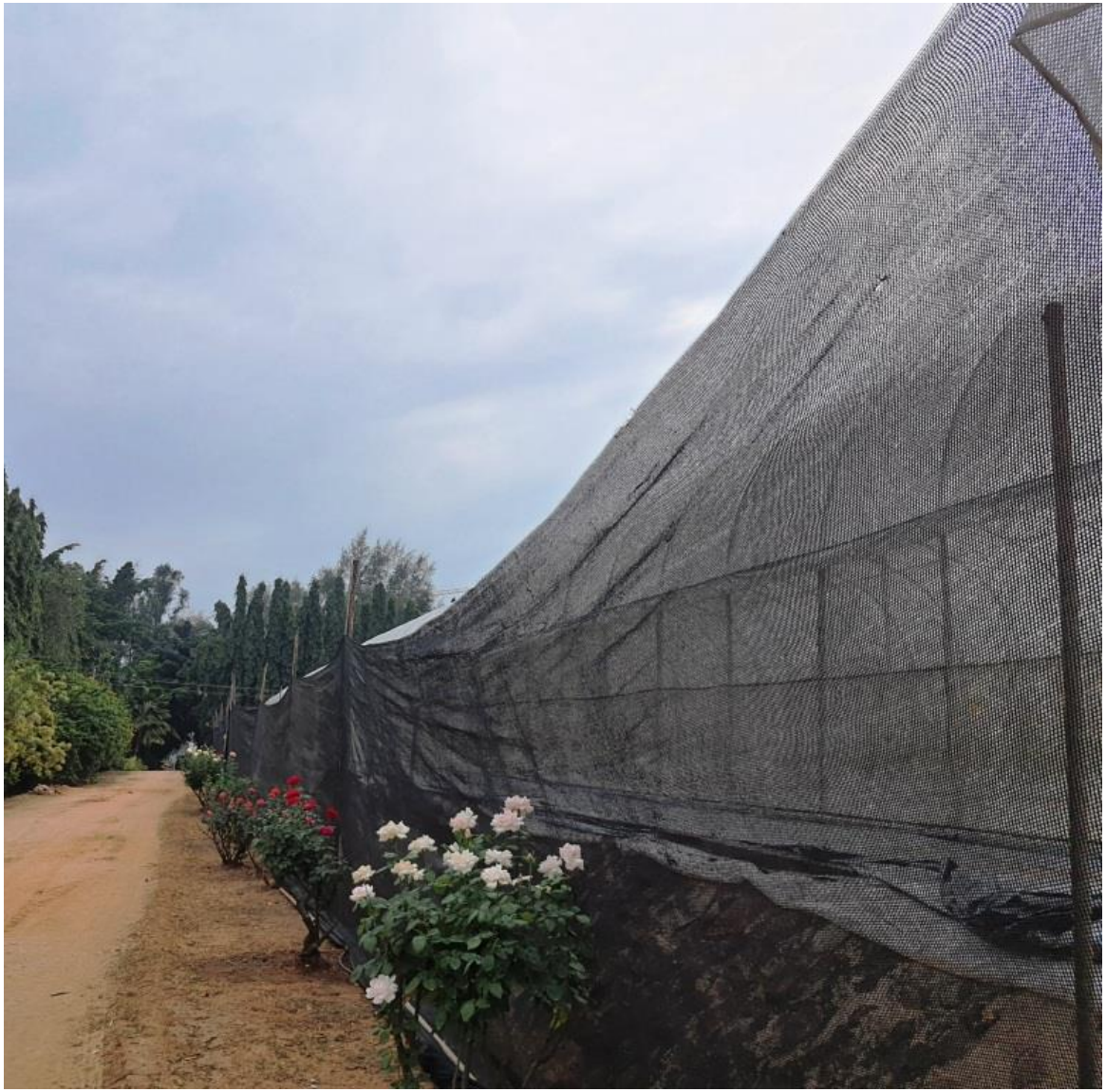


Planting & Vegetative care

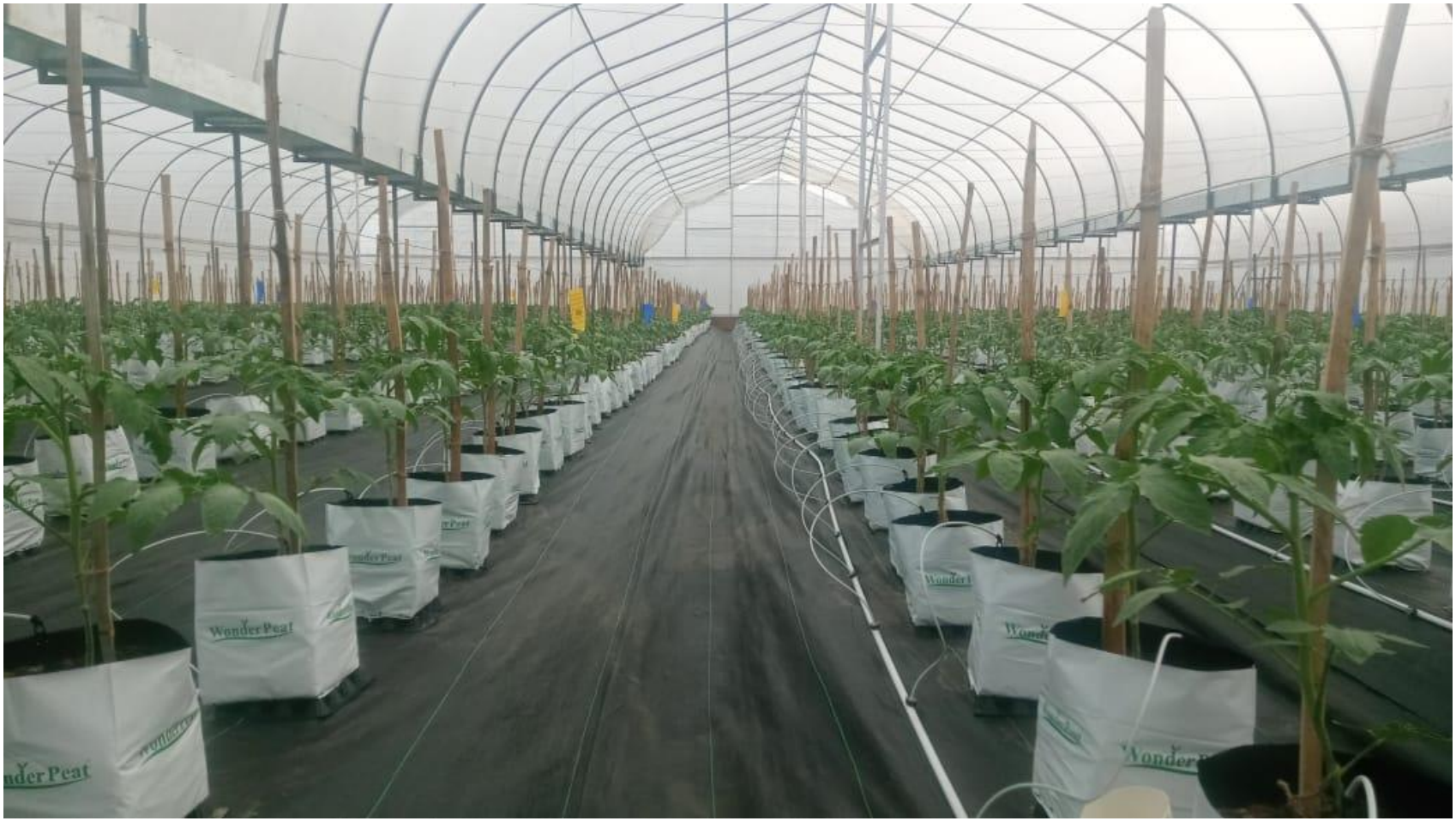
- Transplant hardened seedlings that are ready
- Use proper disinfection protocol- for people & also tools while working in the unit
- Maintain specified planting distance to ensure proper intercultural operations & aeration.
- Stake/ Train plants as per crop needs
- Substrate production needs frequent fertigation schedule composing all nutrients in balance
- Prophylactic measures should be in place to avoid pest & disease impact
- Look for any off-types/diseased plants and remove them before pollination starts

Substrate seed production

Barriers to isolate production plot



Early vegetative stage

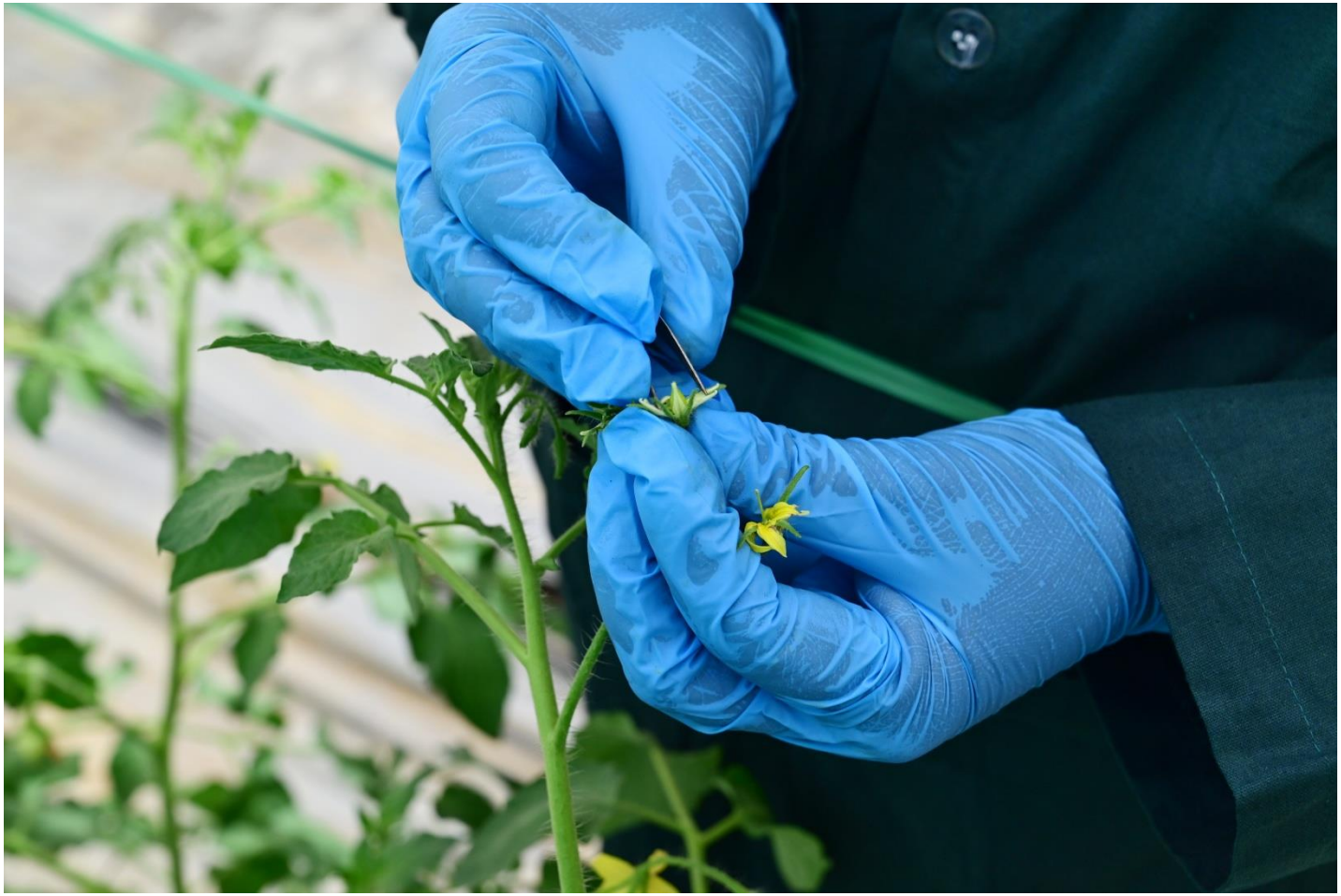


Vegetative stage

Pollination & Post Pollination

- Follow standard pollination practices to ensure good genetic quality
- Always allow balance between crop/ plant type and fruit load to be on the plant
- Ensure proper crop protection practices to avoid pest/ diseases in the fields
- Look for any variations in plant / fruit type during rouging. Quality team visits to be done at seedling, vegetative ,fruit development and before harvest stages.
- Check for phyto sanitary requirements & get field inspections done through relevant authority

Emasculation



Pollination

Hybridized fruits

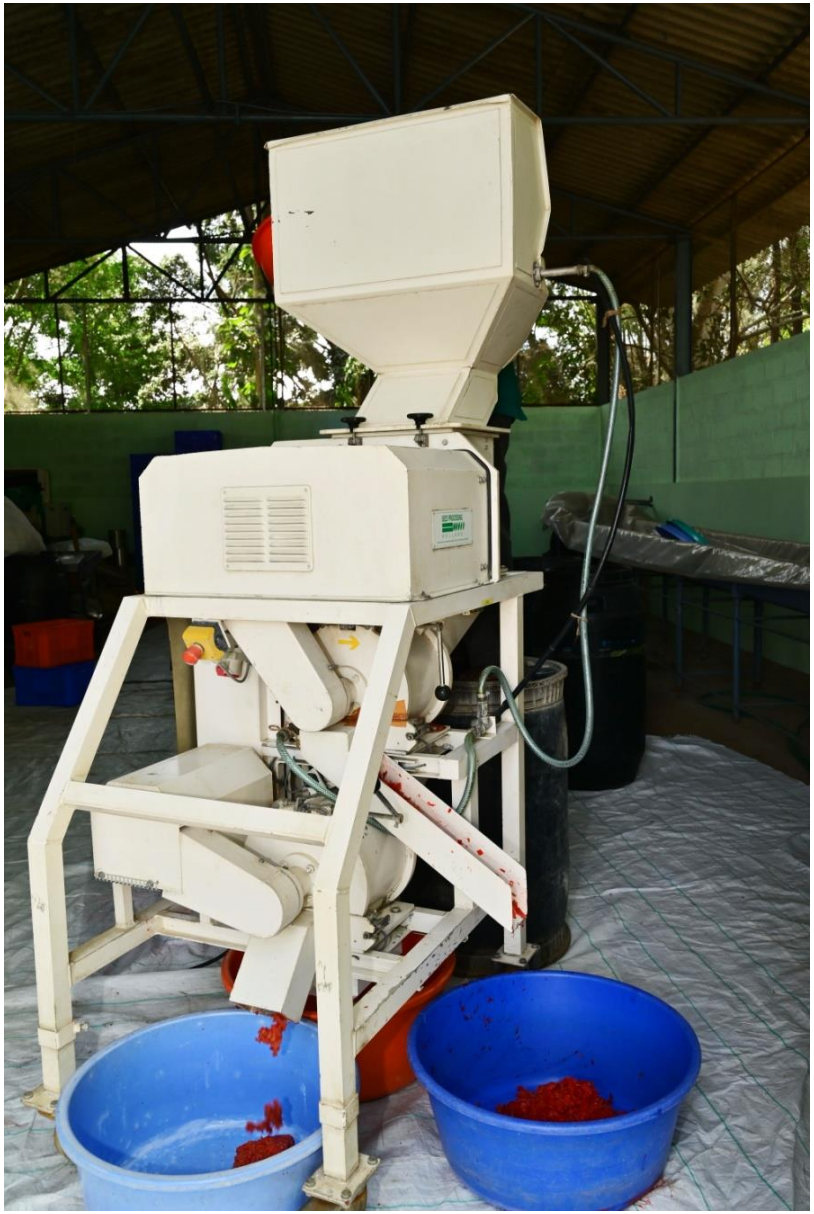
Hybridized fruits

Harvest & Post Harvest

- Harvest fruits at proper ripening stage using clean seed practice
- Allow fruits to stay in shade for specified duration for after-ripening
- Seed extraction– to be carried out using clean machinery & tools
- Seed washing & treatment to be followed using clean water and using recommended chemicals
- Dry seeds using dryer for uniform drying and to retain best physiological potential
- Clean the seeds for any abnormal, discolored seeds and also any plant parts
- Pack the seeds using plastic & corrugated boxes and store in hygienic dry cold conditions

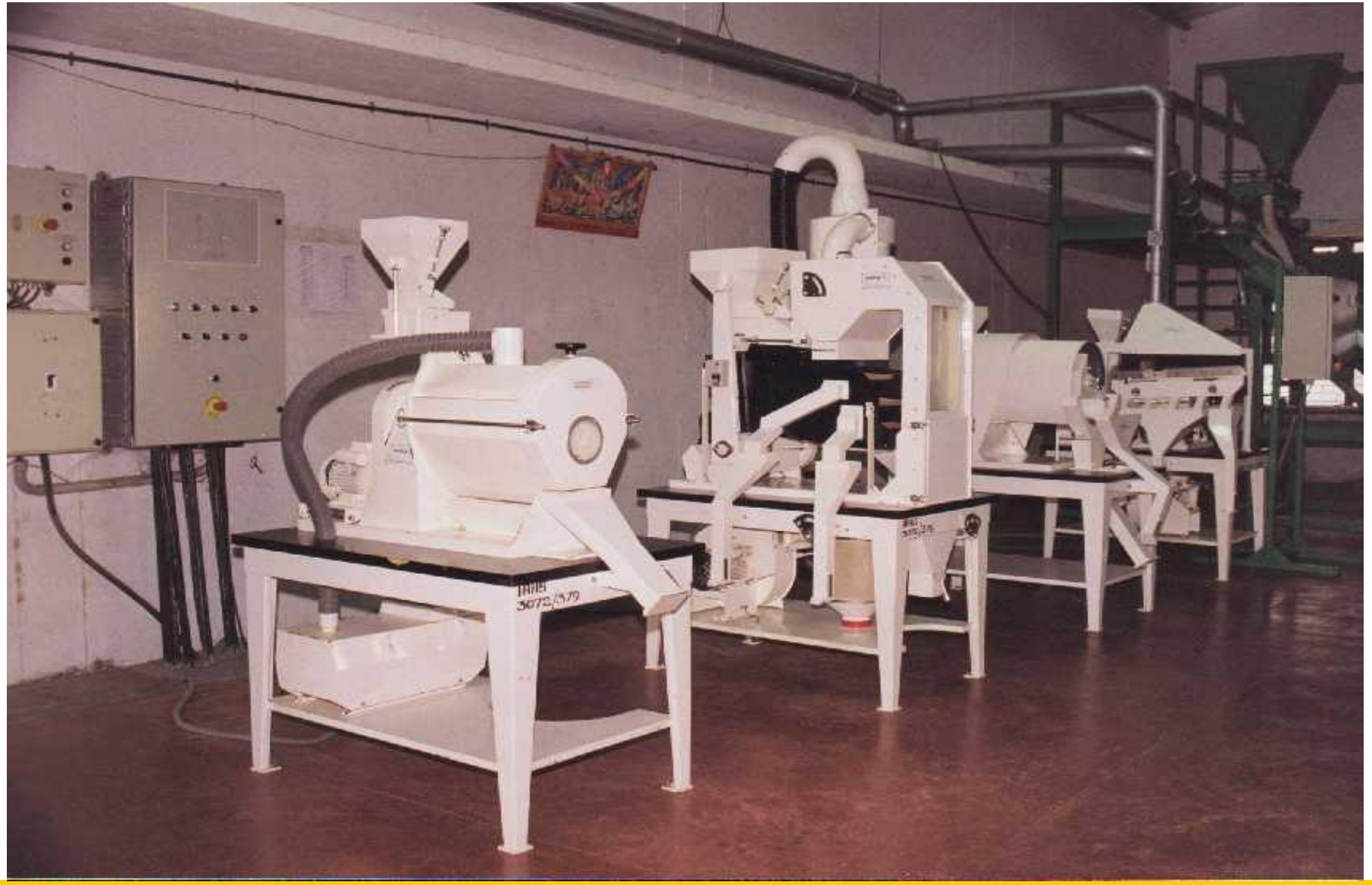
HARVESTING

WET SEED EXTRACTION



SEED WASHING

SEED PROCESSING LINES



TEMPERATURE & HUMIDITY CONTROLLED SEED STORAGE

Indo-American
Hybrid Seeds (India) Pvt. Ltd.

SYMBOL OF QUALITY

SEED TESTING: EXPORT AND DOMESTIC REQUIREMENT

ISTA — **ISTA AND NABL ACCREDITED LABORATORY** — **NABL**

ISTA Certificates: ORANGE AND BLUE

SEED EXPORTING COMPANIES:

- Promote business Internationally;
- Increases acceptance of seed lots globally.
- ISTA Certificates promote your business successfully with your customers and stakeholders.
- Assuring the gold standard seed quality
- Certificate abide by the law of the

NABL certificate

INDIAN SEED COMPANIES

- PASSPORT for seed marketing in India
- Ensures guaranteed the seed standards
- Certificate will stand in the court of law
- Varietal/Hybrid registration: State and central government
- Ensures to trade B2B within India

Testing Scopes

ISTA

- Sampling
- Physical Purity
- Germination
- Moisture test
- Seed vigor
- Seed Health

NABL

- DNA fingerprinting
- Genetic Purity of Seed Lots
- Physical Purity
- Germination
- Moisture test
- ToMV/TMV
- Paddy blast

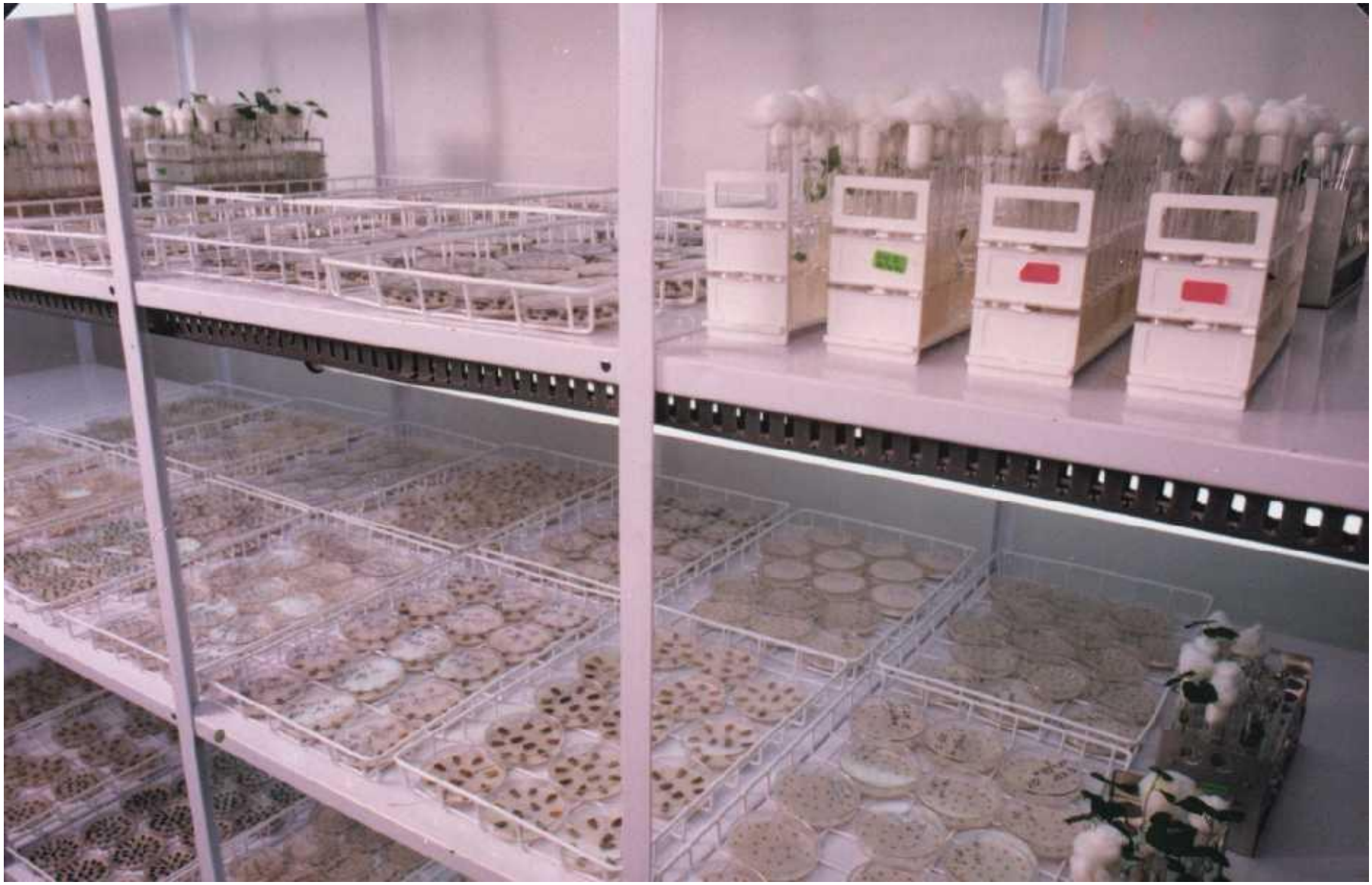
Contact: sqal@indamseeds.com
9845274209/9972551810/9448938659/9740649333
www.indamseeds.com

ISTA LABORATORY

MOISTURE TEST

SEEDLING EVALUATION

SEED HEALTH TEST



Quality management system

Stage	Objective	Quality measurement
Genetic selection	Using plant breeding technoue to obtain the new imporved variety for commercialization.	Field inspection and laboratory test in case the symptoms are found. Seeds are also tested to ensure high genetic purity and free from seed transmitted diseases
Parental seed production	To produce starting material (male and female seeds) for seed production	
Seed production	Male and female lines are sowed to produce hybrid seeds. The field inspection is done according to the quality standard of the company to ensure high genetic purity and manage the plant diseases.	
Seed harvesting	Final process of seed production. The fruits must be harvested at the right time to ensure high germination, high genetic purity and free from seed transmitted diseases.	
Seed sanitation	The chemical used in this process depends on the crops/variety.	
Seed drying	Reduce the seed moisture content to maintain seed longivity	Seeds are tested to guarantee the quality of germination, genetic purity and seed health.
Seed conditioning/cleaning	Remove non-seed materials and to separate seeds into different sizes referring to the requirement of the market	
Seed treatment	Fungicide and other additives (biological agent, polymer, etc) can be added depending on the company and the requirement of the customer.	
Packaging and storage	Ensure the germination, vigor, genetic purity and seed health are maintained until the packages are distributed to the end customers.	

Thank you