VETIVER SYSTEM

Propagation and Nursery

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Sexual propagation: by seeds?

Florescences of Vetiver 3, 5, 10, 15 days after flowering having about 2,000 flowers each

Flower structure

Sessile spikelet only contains stigma without anther

Pedicelled spikelet contains stigma and anther

Pollen Development

Anther of flowers 7 days after flowering

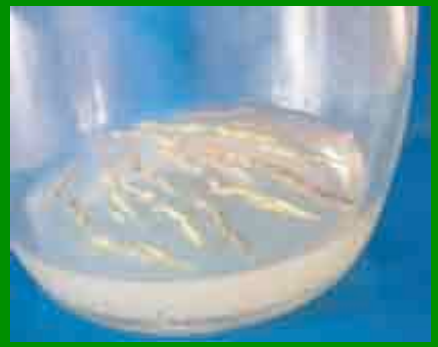
Separated anther *in vitro*

Pollen grain in vitro

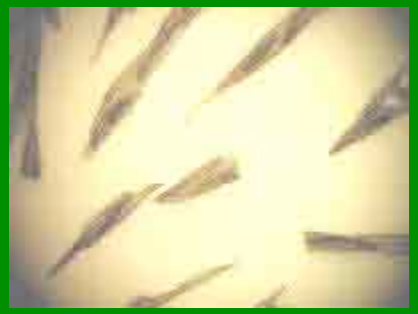
Pollen grain not germinating 13 days after sowing *in vitro*

Germination of seeds?

Inflorescence 20-25 days after flowering



Seeds were sowed *in vitro*



Seeds do not germinate 14 days after sowing

Sexual propagation: by seeds?

Conclusion

From the investigations, ecotype (*V. zizanioides*)

- **Vetiver induces flowers**
- **Seeds do not have endosperm, therefore no germination**
- **This ecotype can not become a weed**

Asexual Propagation Methods

Goals: High multiplication rate and low cost price

The two commonly used methods for large scale propagation of vetiver are:

1- Separation or splitting
   * a mature vetiver plant.
   * side shoots
   * culm cuttings

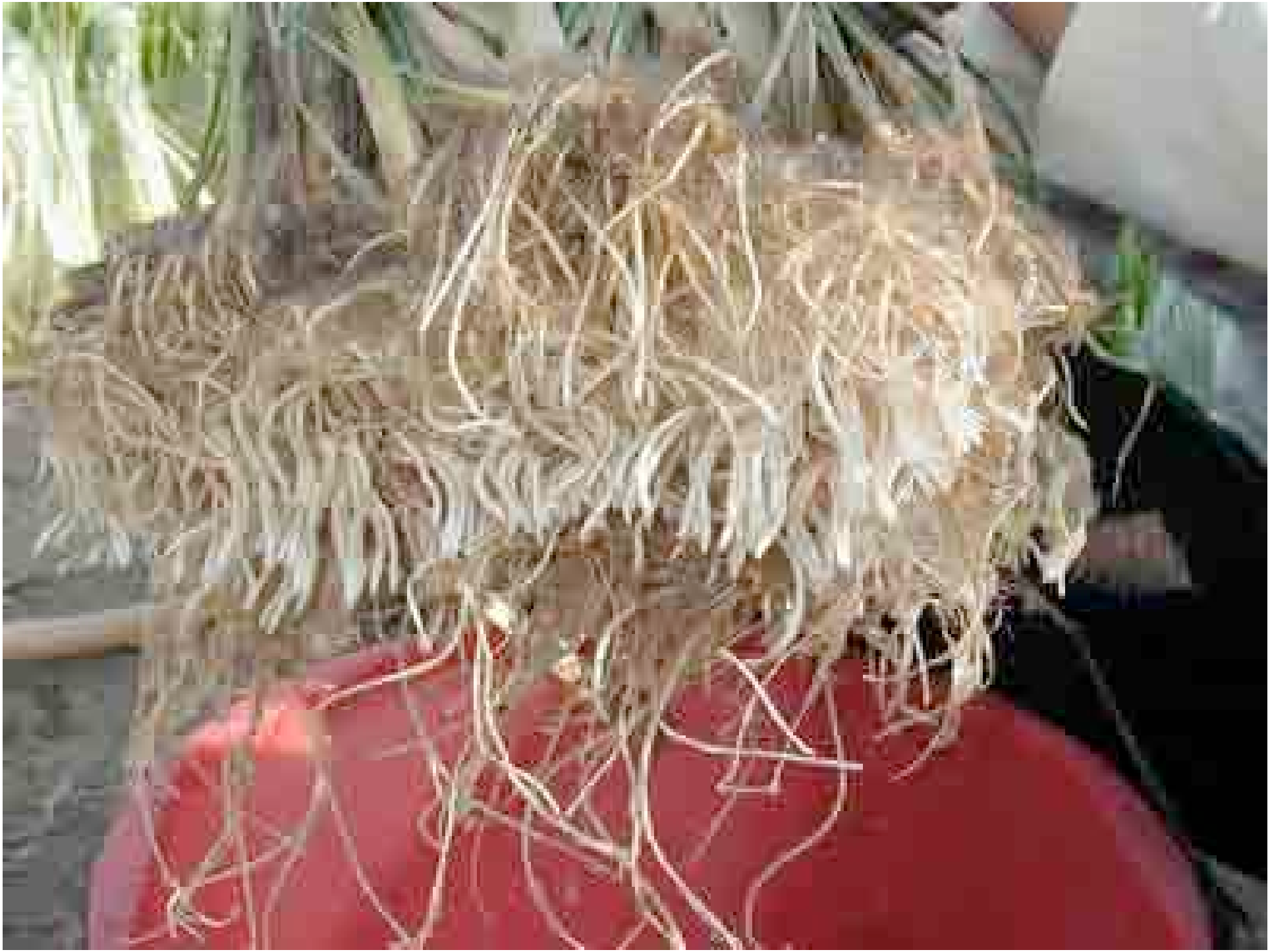
2- Tissue culture

Asexual propagation by splitting from a mother plant

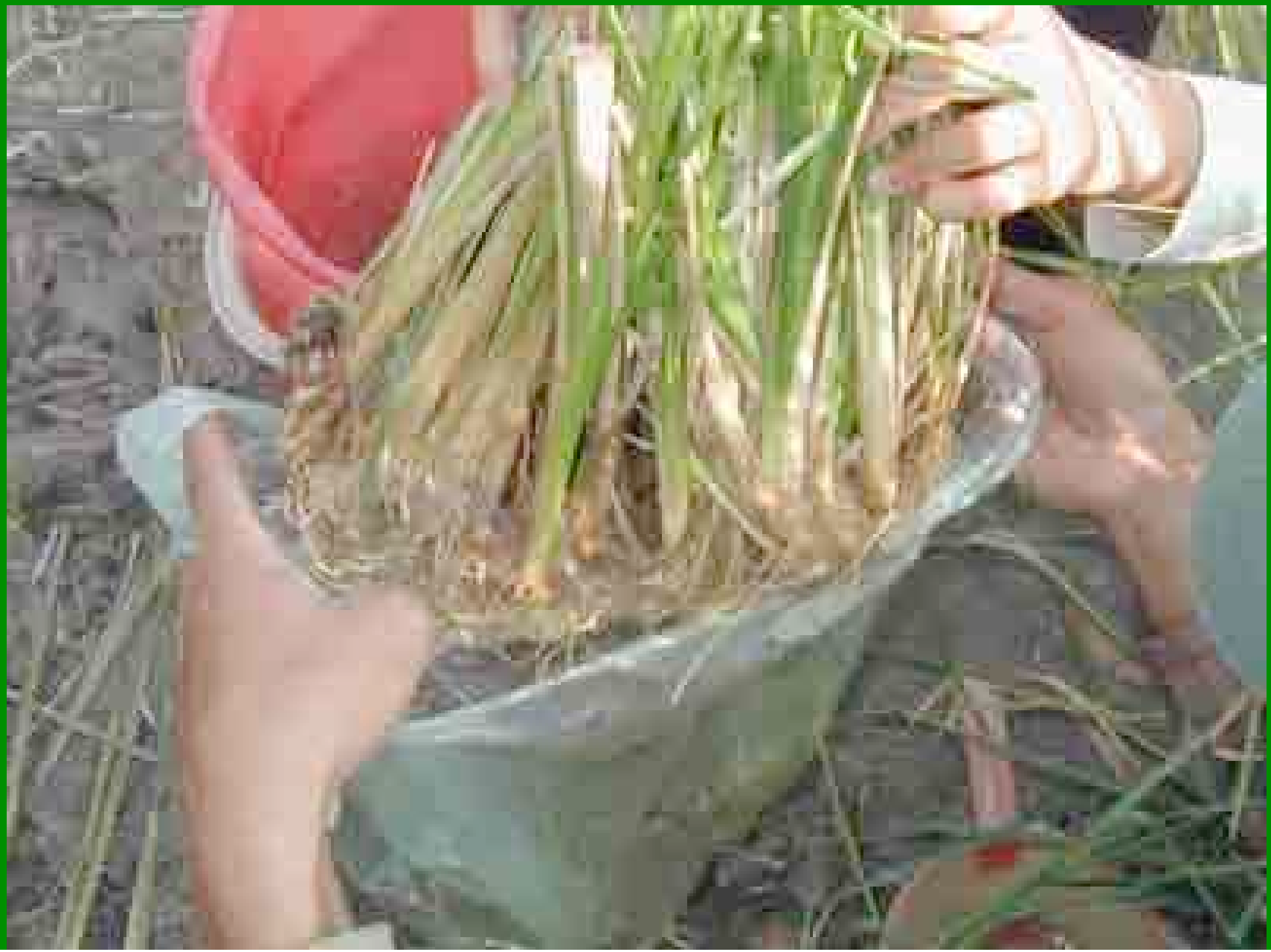
Shoot and root growth from the slips

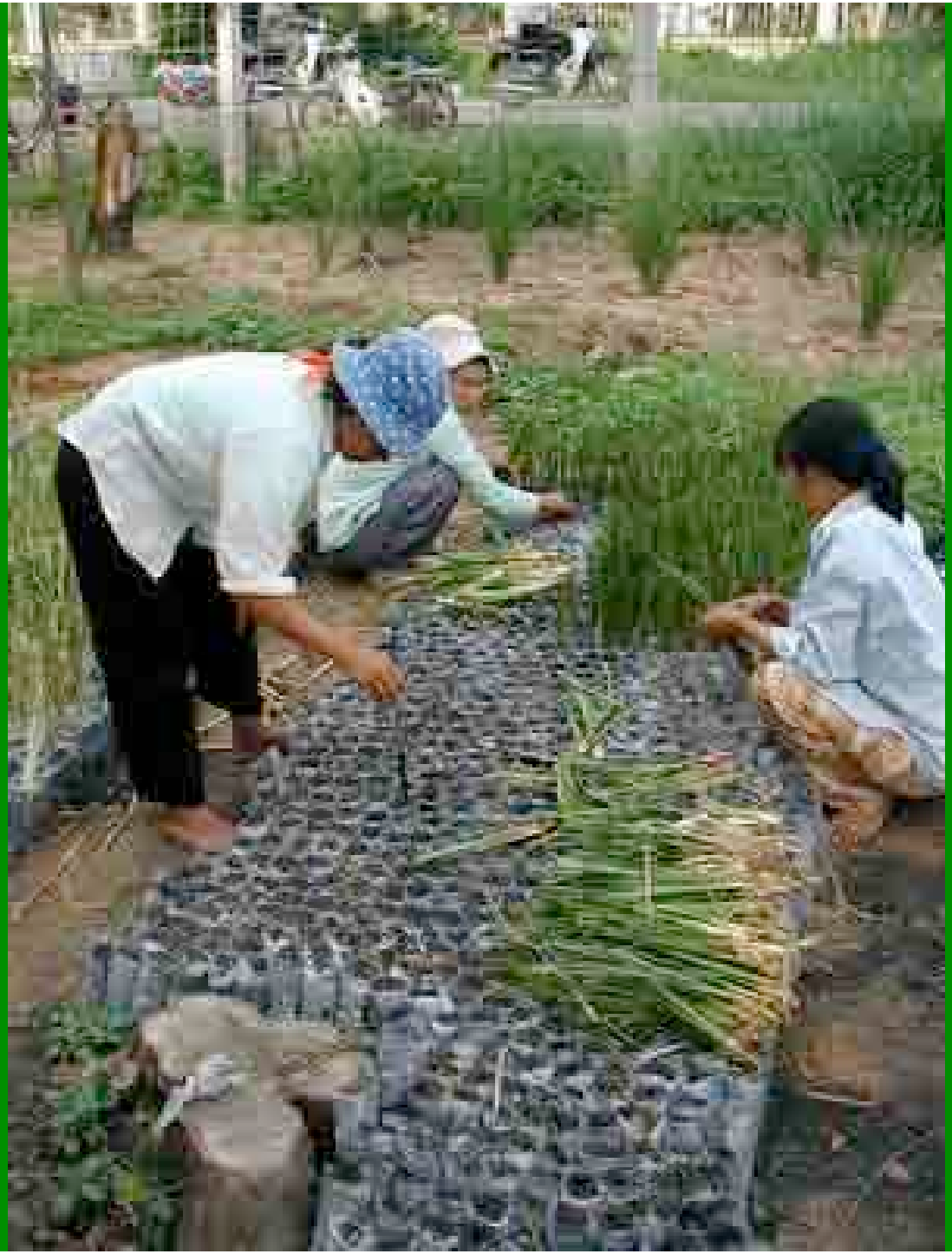
Bare root slips: Dipping in rooting hormone (optional)

Bare root slips after about 10-15 days in hormone



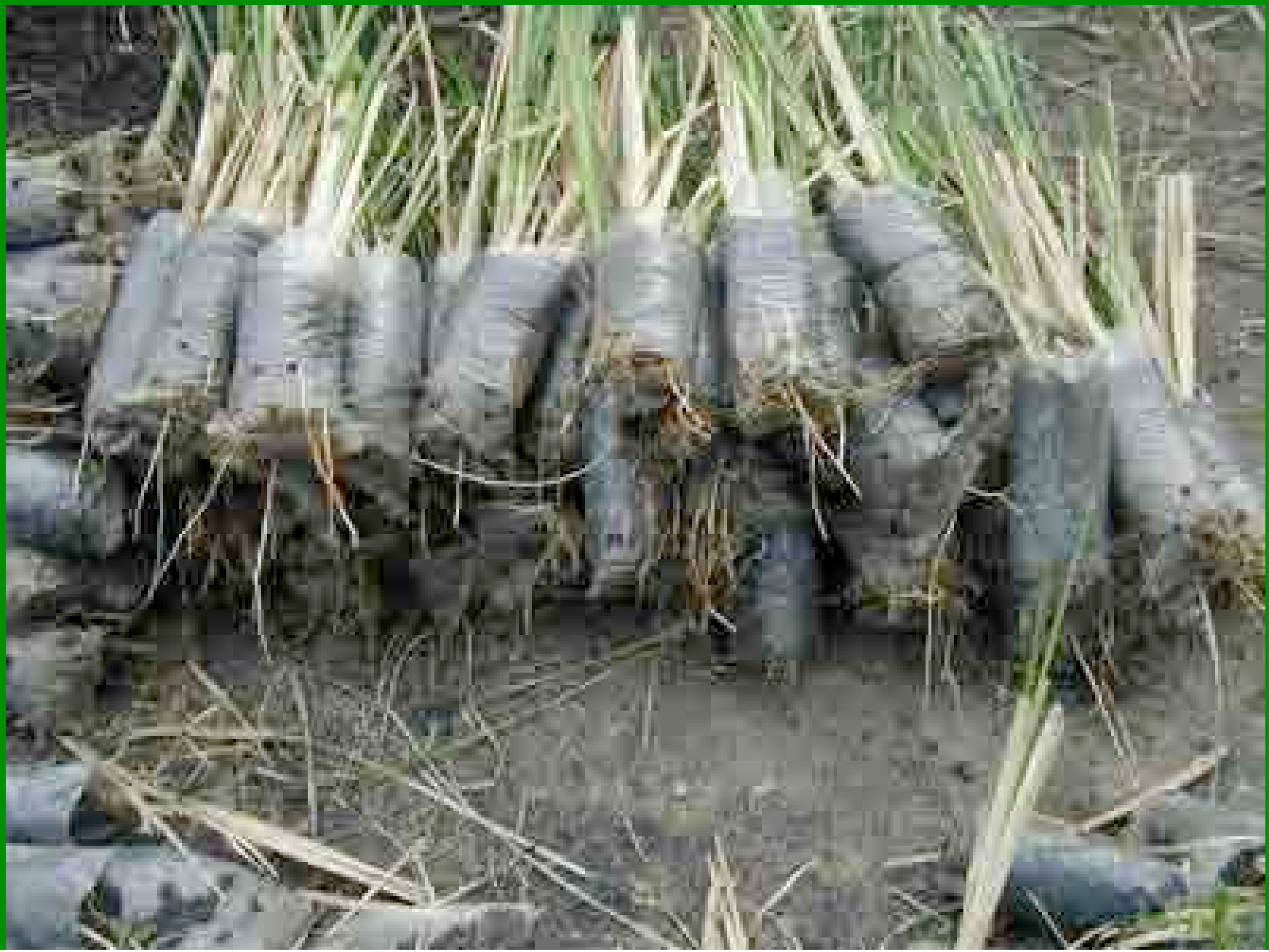
Bare root slips ready for planting directly to site or to polybags





Bare root slips transplanted to poly bags

Polybags ready for planting directly to site

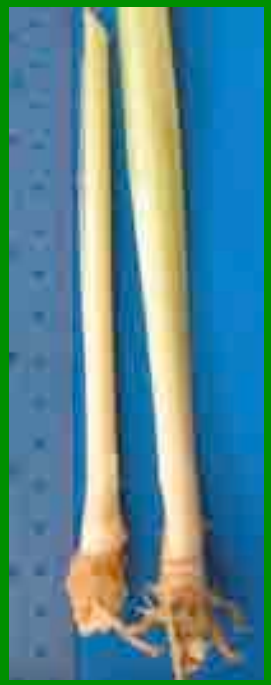


Bare root slips on the left and tube stocks on the right

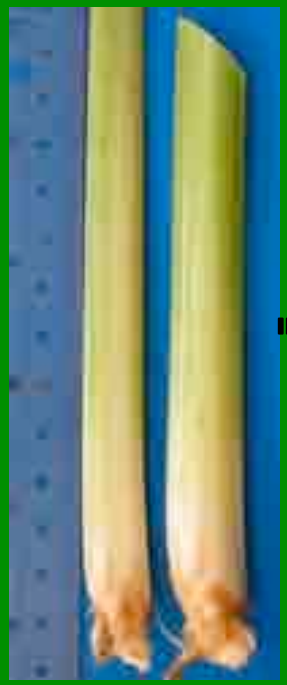
Asexual propagation from a mother plant

A mature culm can initiate side shoot under certain conditions

Asexual propagation by culms

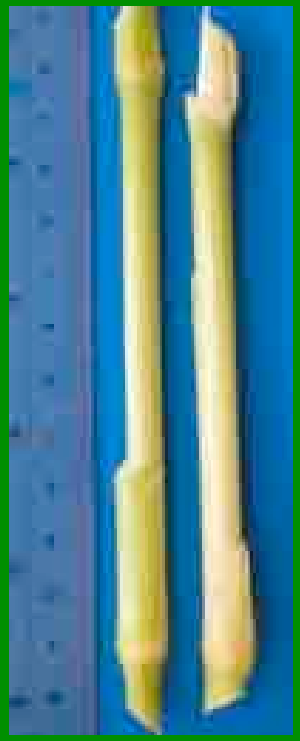


Mature shoots



Young shoots

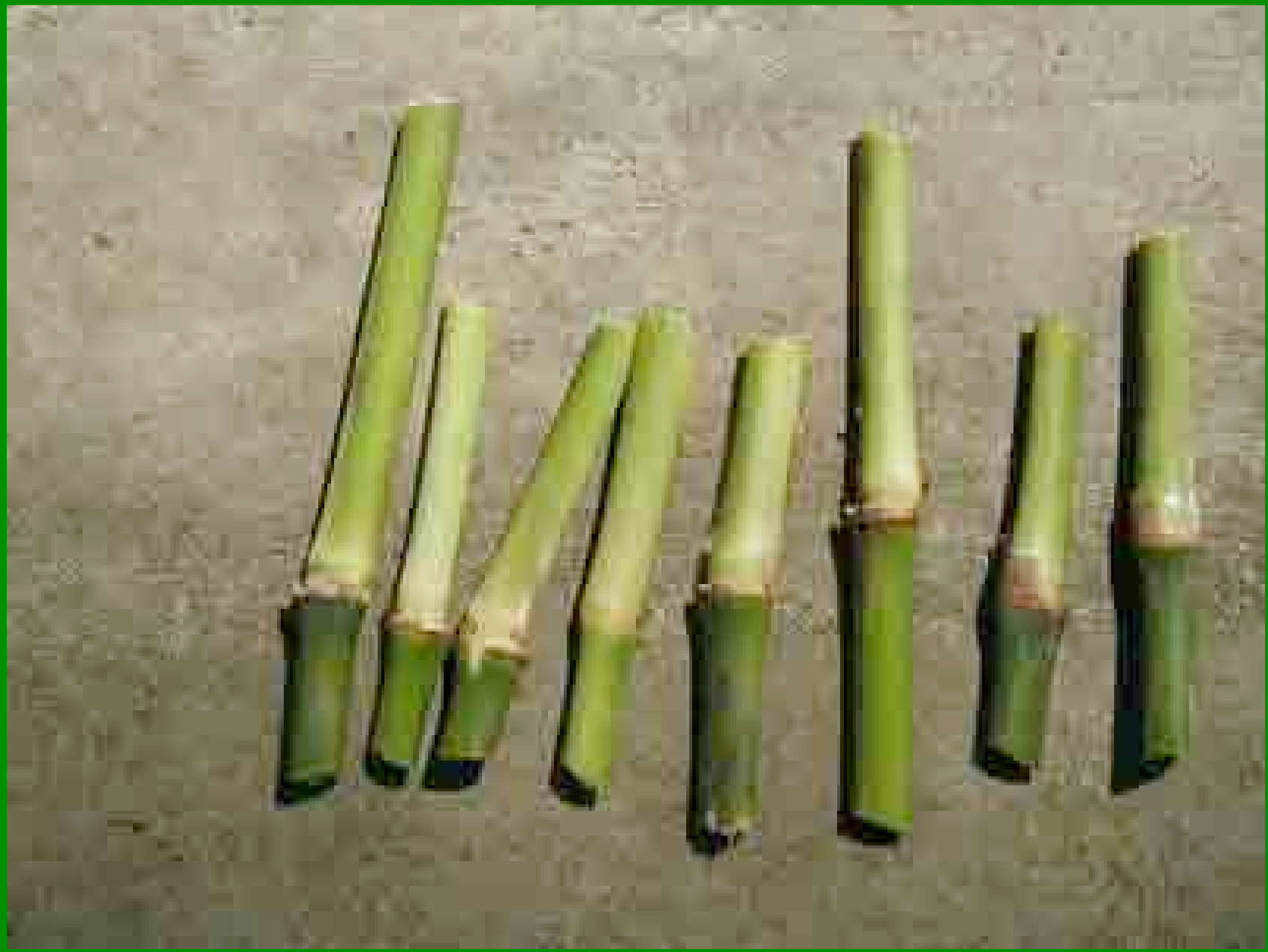
Results: with 85-90% rooted without hormonal treatment



Culm Cuttings

Results: with 65% rooted without hormonal treatment

Culm cutting



Root growth from bare root slips and culm cuttings

Planting strip: For immediate results and fast planting

Aerial root pruning: To limit root growth to reduce shock after planting and for ease of transport

Asexual propagation by tissue culture

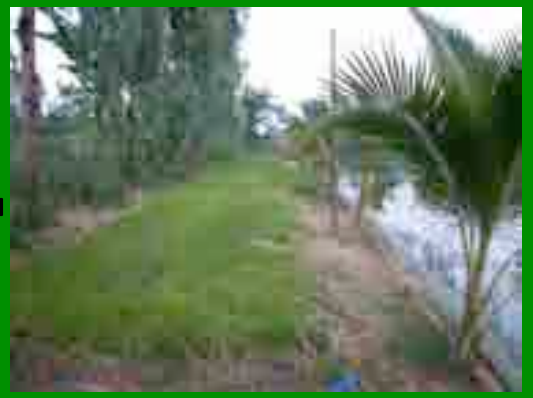
Lateral buds

In vitro

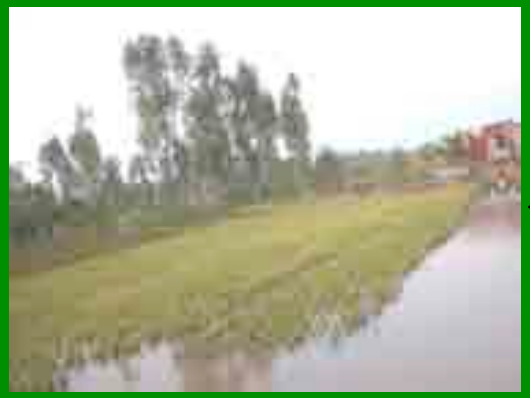
Induce explants

+ Cytokinine

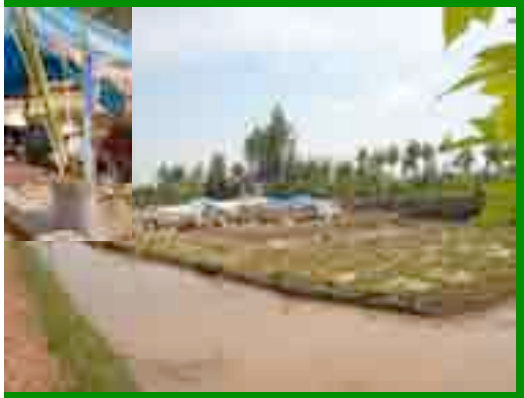
Proliferation in the nethouse conditions



Acclimatization



Multiplication in field



Plantlets ready

Asexual propagation by tissue culture

This method was developed at Cantho University, Vietnam and has been used successfully in the last few years for commercial production

High multiplication rate (hypothetically 58 million plantlets per year)

Proliferation stage (modified 2 mg BA/liter) carrying out in the shade house will be reduce 13% production cost of each plantlets

Advantages and Disadvantage of Bare Root Slips

Advantages:

- Very efficient, low cost and fast to prepare the planting material
- Small volume for transport, ie lower delivery cost
- Very easy to plant out by hand
- Can be mechanically planted out for large areas

Disadvantages:

- Vulnerable to dryness and extreme temperature
- Limited storage time on site
- Need to be planted to moist soil
- Need more frequent irrigation in the first few weeks.
- Recommended for good seedbed sites with easy access to irrigation

Advantages and Disadvantage of polybags or tube stock

Advantages:

- Very hardy and is not affected to exposure to high temperature an moisture stress
- Lower irrigation frequency after planted out
- Faster establishment and growth after planted out
- Longer period of storage time on site
- Recommended for harsh and hostile environments

Disadvantages:

- More costly to produce
- Longer period to prepare, 4 -5 weeks or more
- Large volume and heavy load for transport, ie higher delivery cost
- More maintenance cost at site after delivery, if nor planted out within a week

Advantages and Disadvantage of Tissue Culture Method

Advantages:

- A very large number of plant can be produced very quickly
- No need for a large scale nursery
- Smaller volume and weight for transportation
- Free from pest and pathogen in nursery

Disadvantages:

- The need to set up a small laboratory, which can be expensive for a small nursery
- The need for a well trained technician and other skilled staff
- The need for more manual labour to transfer the seedling to different size pots during its growing period.
- It takes longer to get the plantlets ready for planting
- More susceptible to pest and disease on site and adverse conditions

Nursery

The main points in establishing an efficient nursery are:

Soil type: **For the ease of harvesting and minimizing root and crown damages, sandy loam to loam is recommended**

Planting *method:* Mechanical or manual

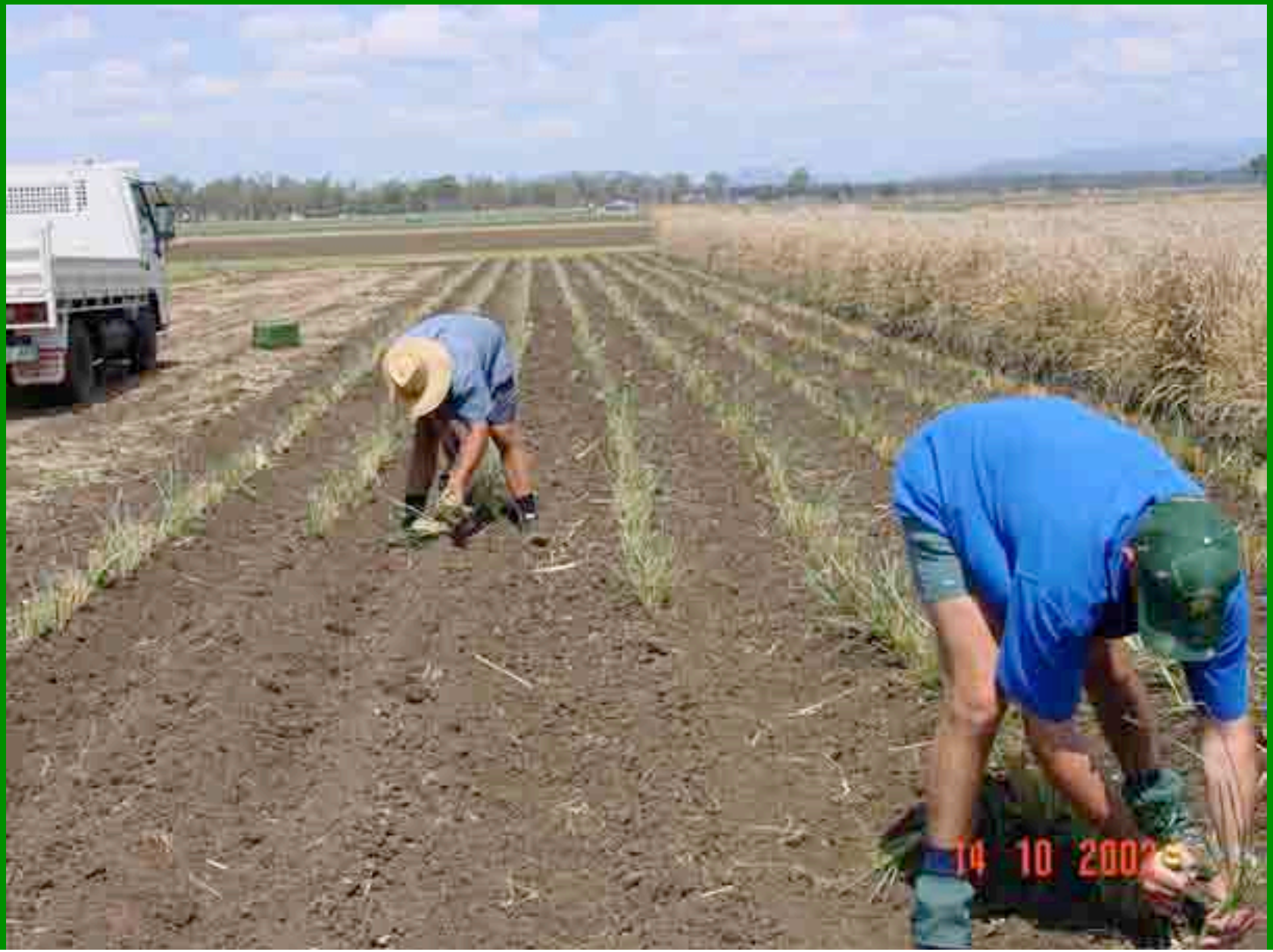
Harvesting method: **Harvesting the mature plants can be done either mechanically or manually. For machine harvesting**

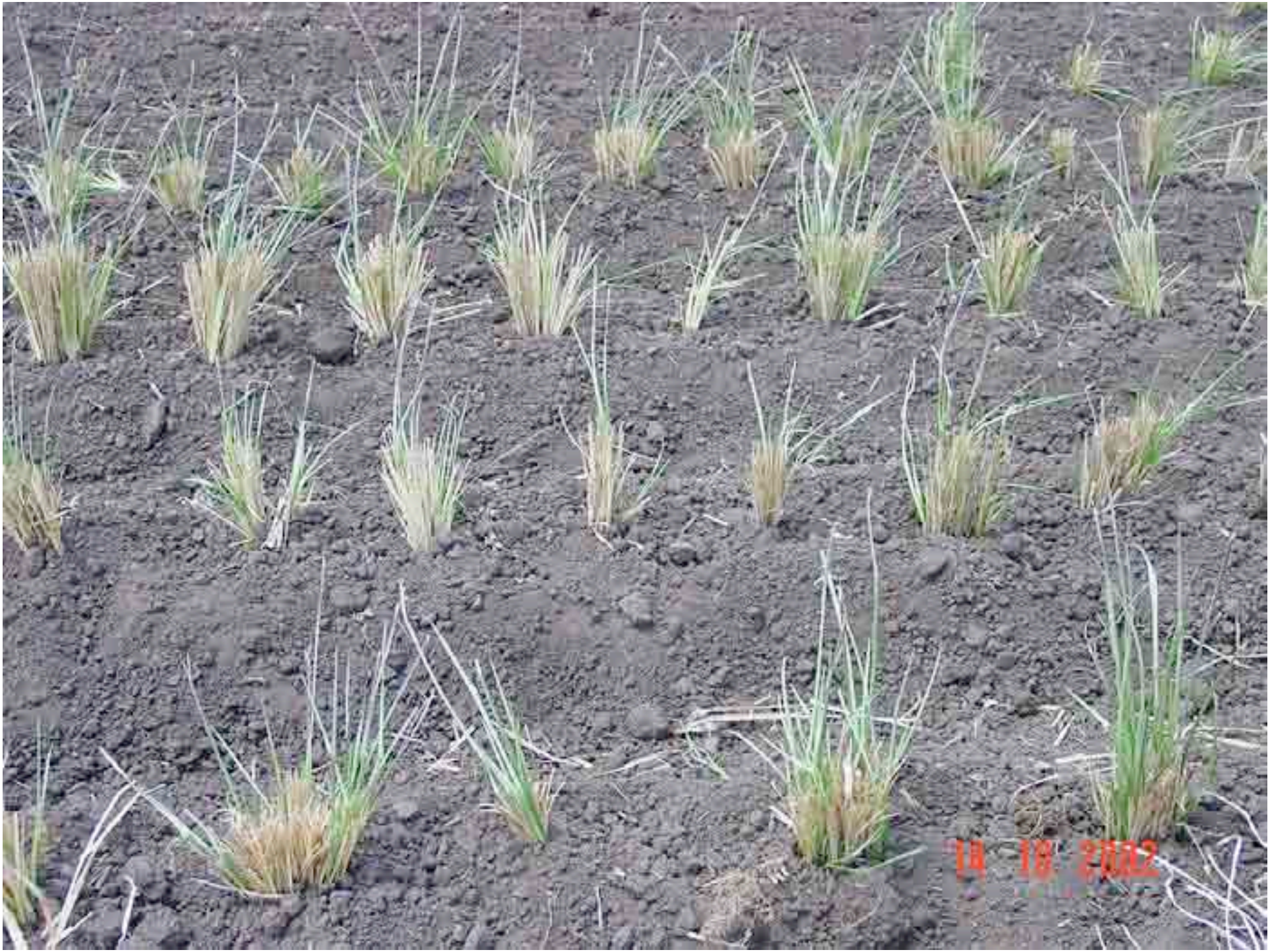
Availability of farm machinery: **Some basic farm machineries are needed for seed bed preparation, weed control, cutting, harvesting etc.**

Irrigation method: **Overhead irrigation or flood irrigation**

Training of operational staff: **Availability of well trained staff is essential to the success of the nursery**

Manual planting in Australia, overhead irrigation and harvested by potato digger

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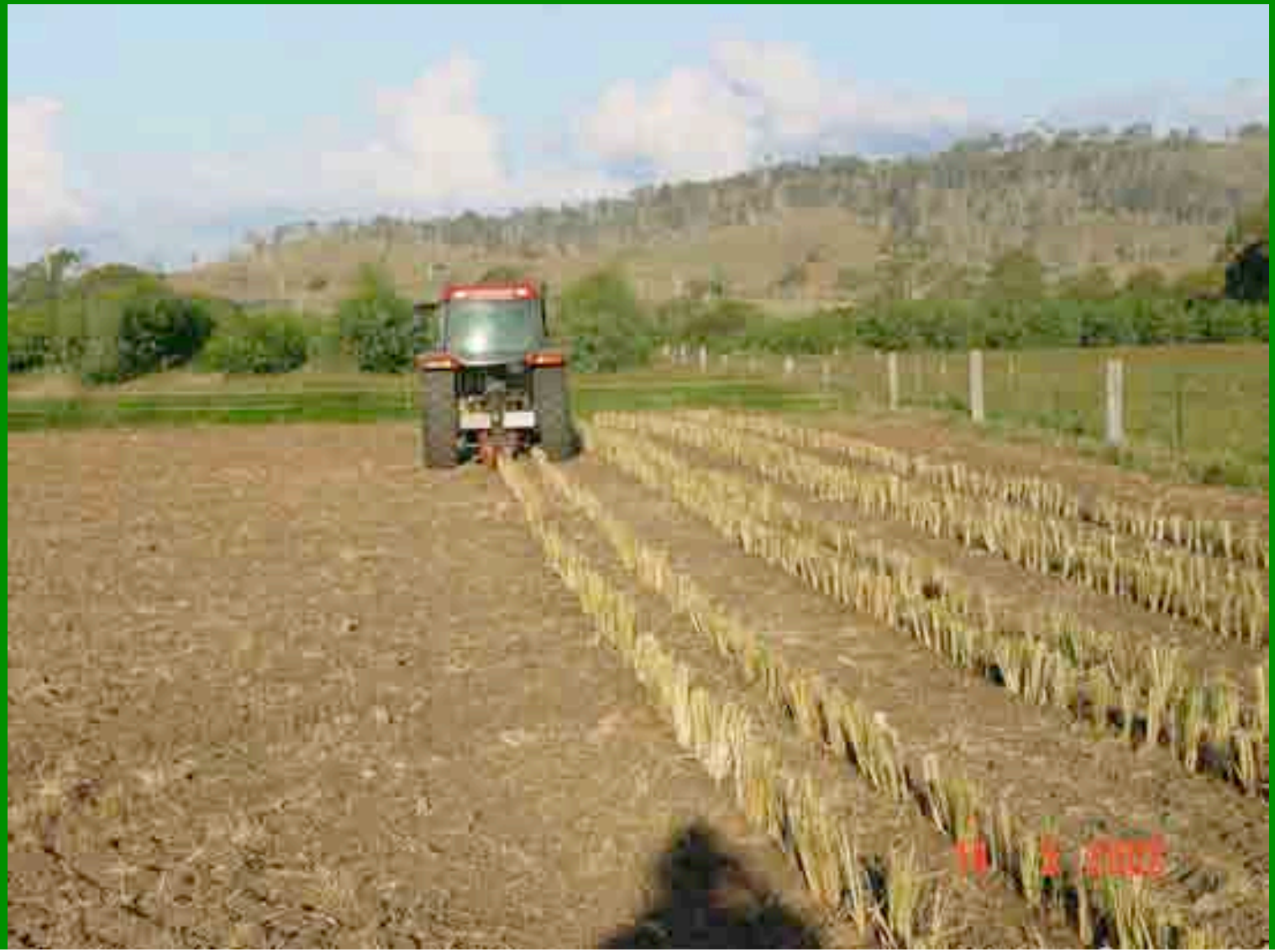
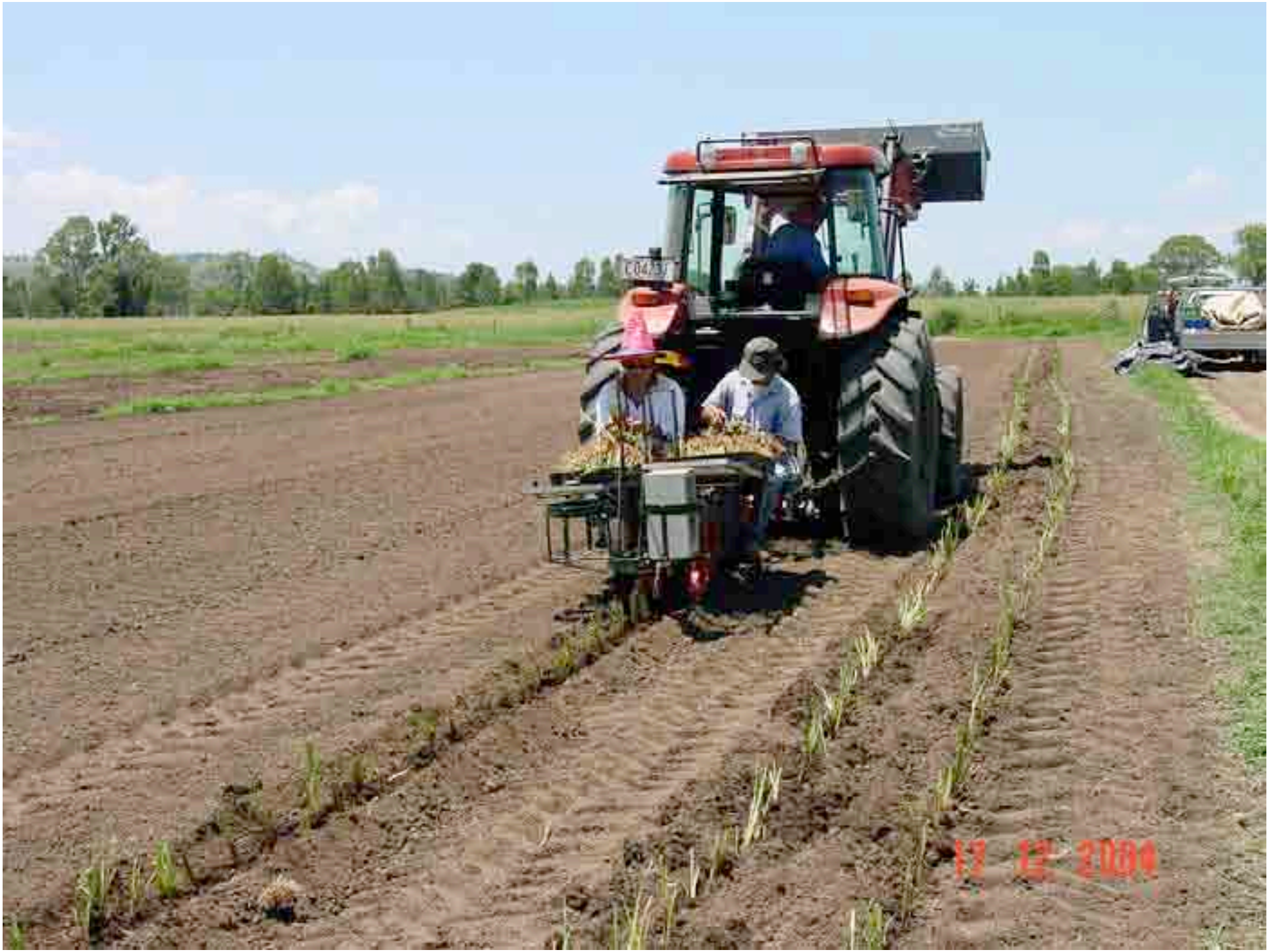
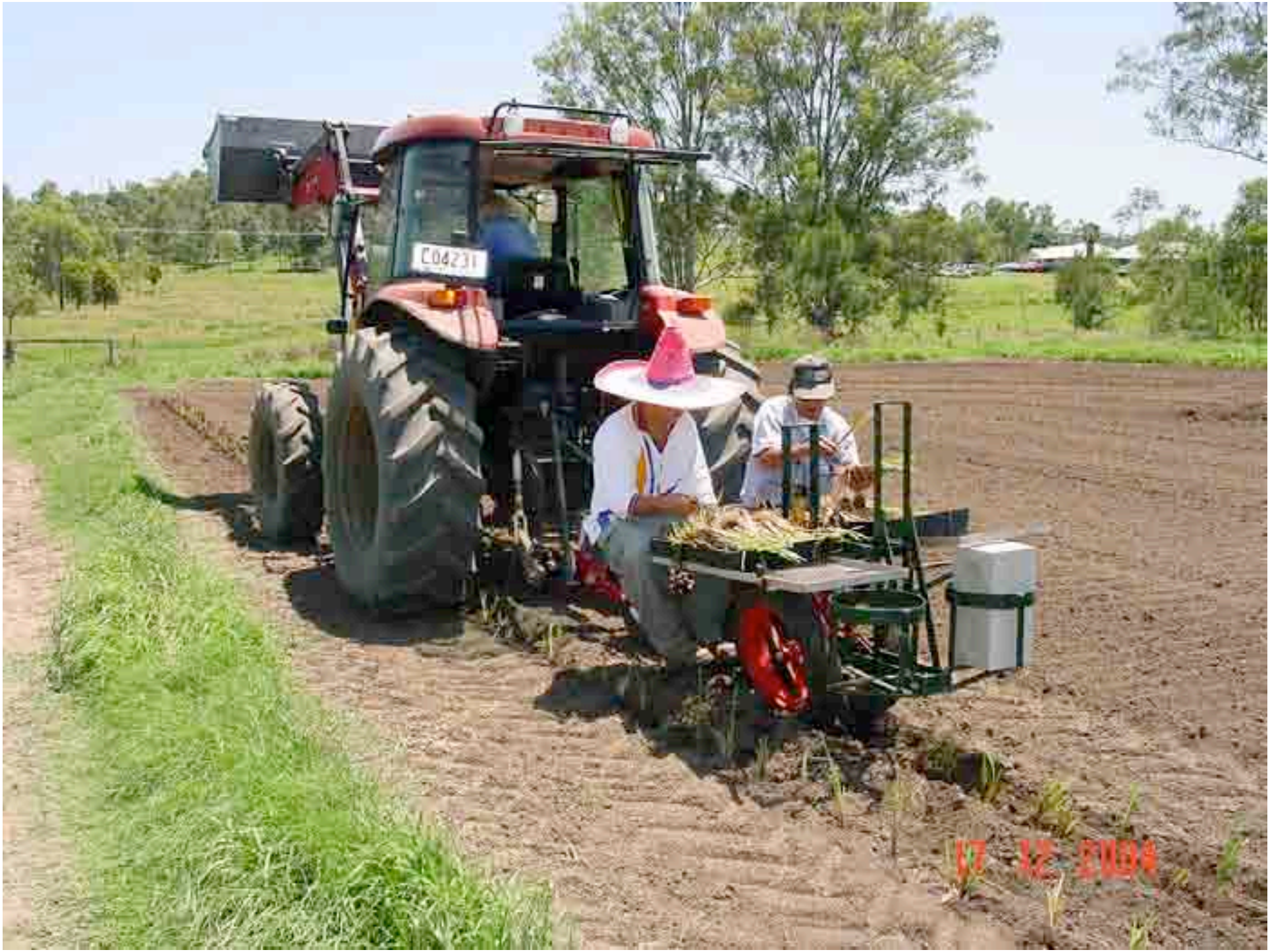
Machine planting in Australia,

Machine planting on flat ground, overhead irrigation and harvested by mouldboard plough



A vegetable planter was modified for planting vetiver bare root slips

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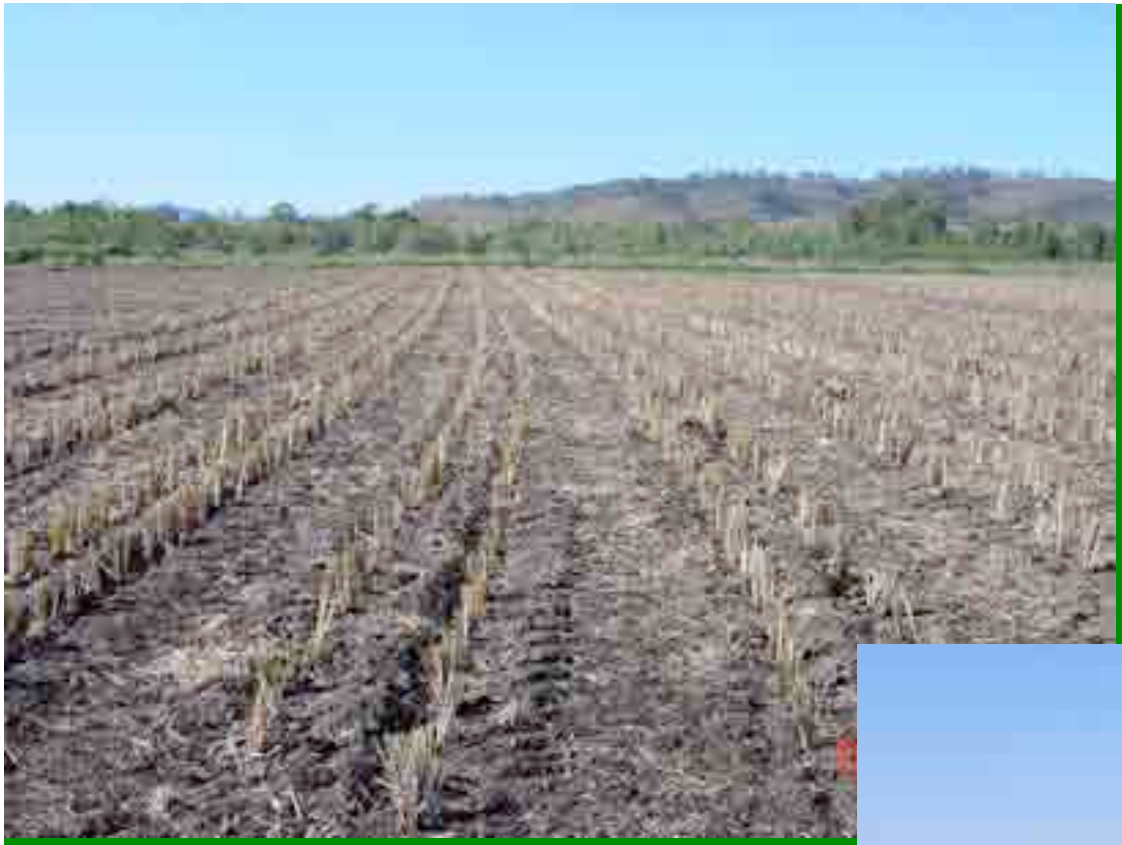
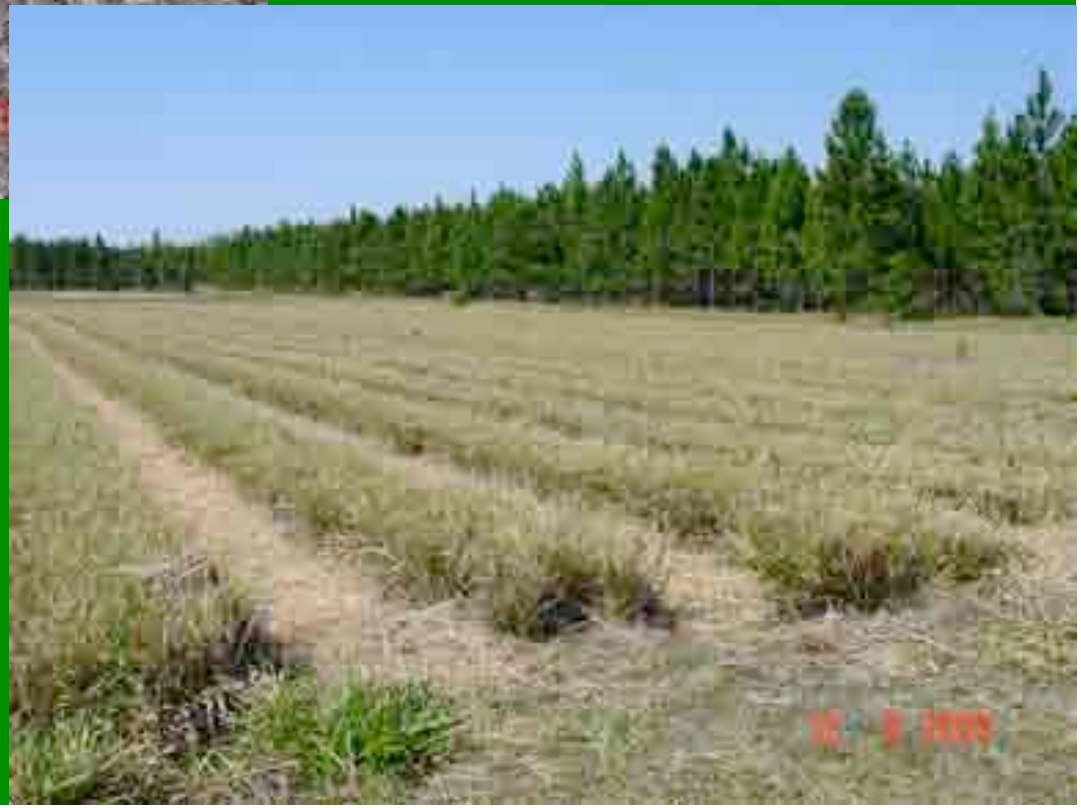
Either single or double line

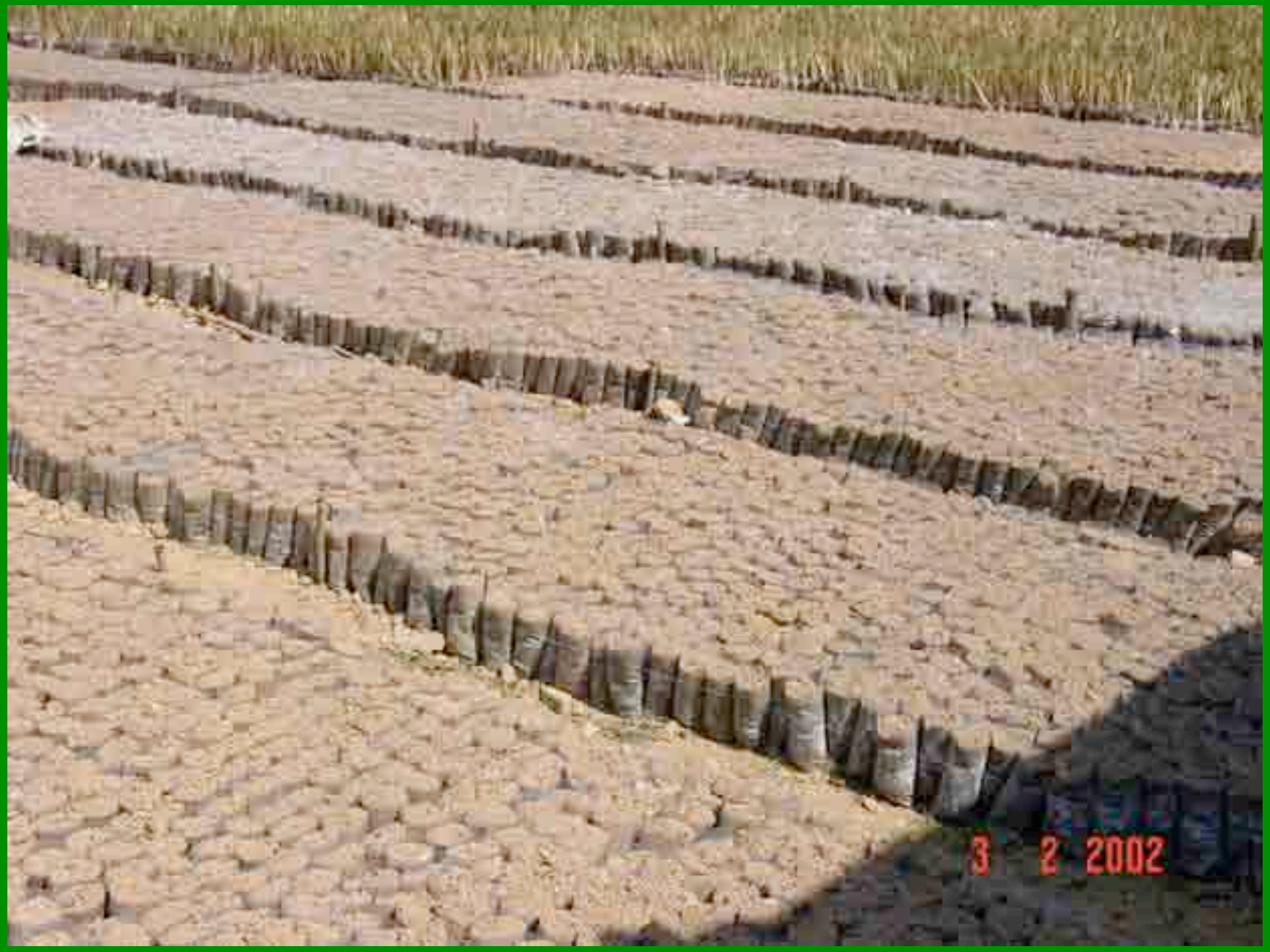




On site nursery in Vietnam

For large project, temporary nursery can be established close to the project site


Planting sites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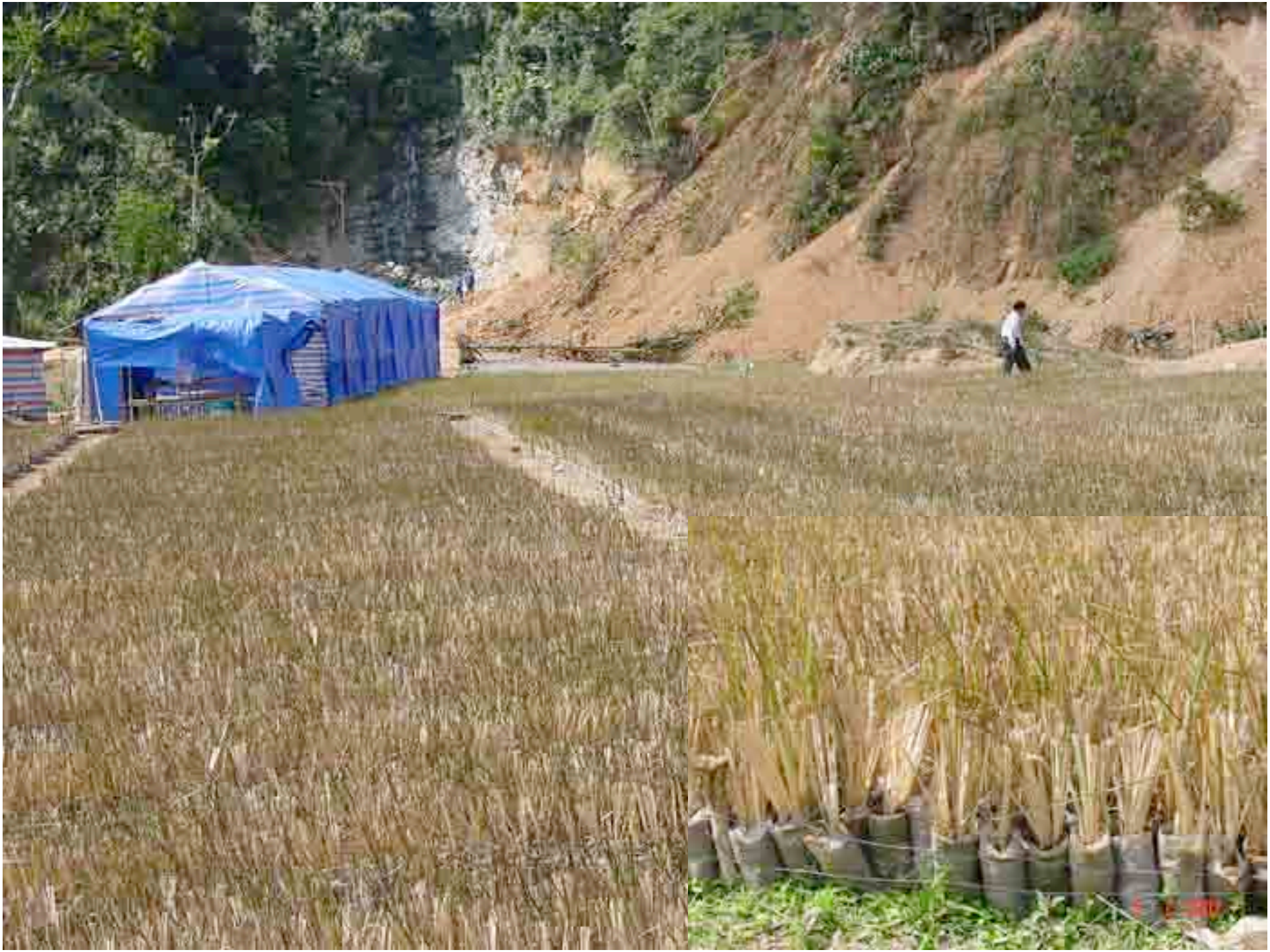
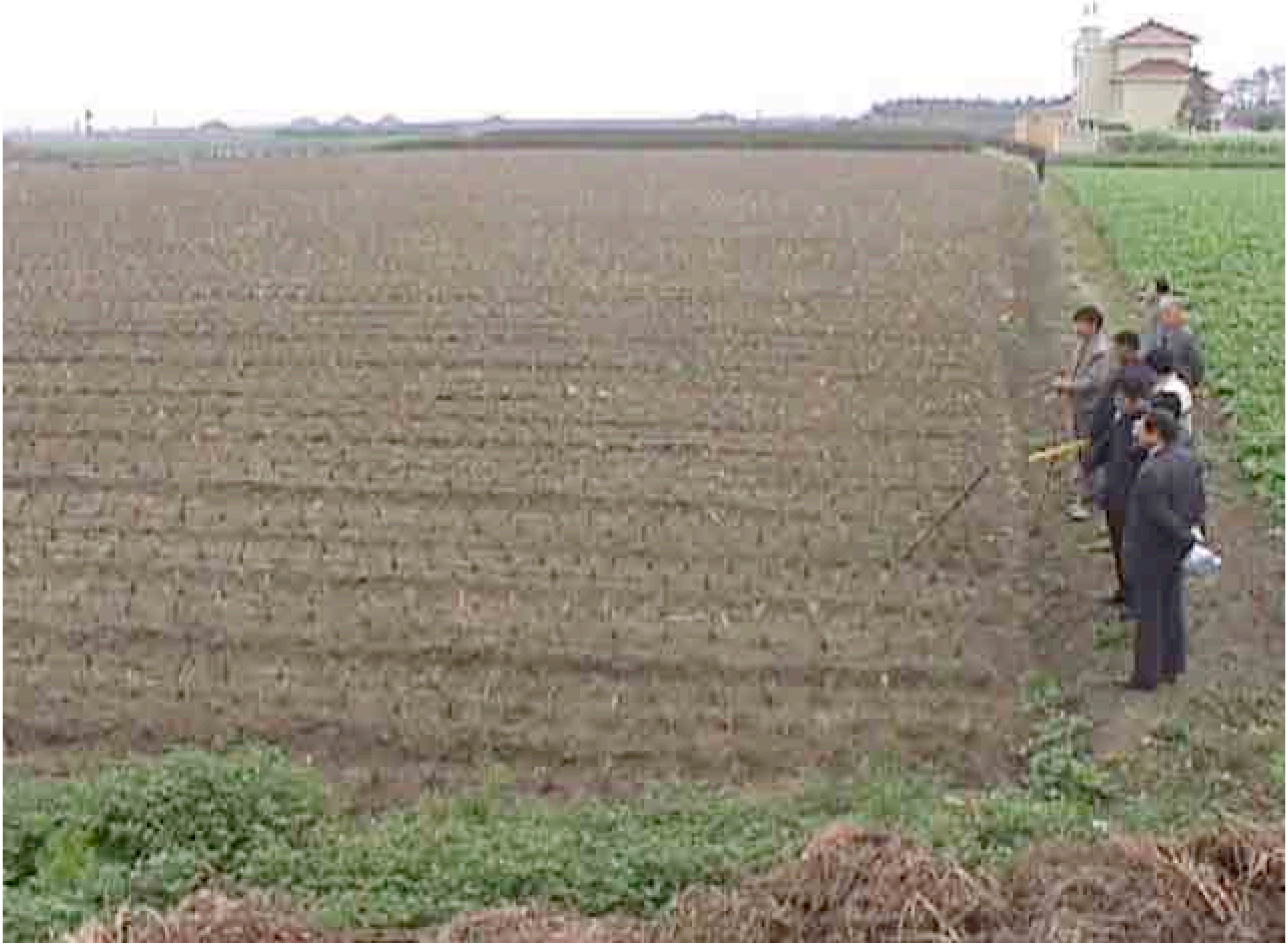


Large scale nursery in China

Vetiver nursery in Guangdong, China. Mature plants background, new planting foreground



Thank You