SUCCESS STORIES

Polytray tobacco seedlings : Boon to tobacco farming

Tray Seedlings are cost effective, free from soil borne diseases, uniform in growth, cent per cent establishment, improves the resource use efficiency, increases the yield by 10-25% adopted by 90% tobacco farmers.

PREAMBLE

Tobacco, one of the important high value low volume commercial crops in India, is valued for its potential to generate farm income and employment to farmers and farm labours, and revenue to the government. It is grown in area of 0.433 M ha in the country. With a production of 721 M kg India ranks third in the world tobacco production, after China with 2997 M kg and Brazil with 862 M kg (2014). Tobacco production is an important source of livelihood and provides direct and/or indirect employment to about 41.6 million people. During 2015-16, tobacco made a significant contribution of Rs. 29,376 crore to Indian economy in terms of excise revenue (Rs. 23,318 crore) and export earnings (Rs. 6,058 crore). Among the different tobacco types grown in India, FCV tobacco is cultivated in Andhra Pradesh and Karnataka to an extent of 1.46 lakh ha producing 190 M kg.

Tobacco seeds very small (0.75x 0.53 mm) with thick seed-coat (approximately 11,000 – 12,000 seeds/ gram of tobacco seed), nursery raising and transplanting is inevitable in tobacco production. Tobacco seed requires optimum temperature (18-25^{o}C) and moisture for germination. Tobacco nurseries raised during summer months when the prevailing temperatures are above 30^{0}C results in very poor germination in the nursery beds.

Conventional Seedling Production

Ideal soils (Well drained light textured soils, with low soil chlorides (< 100ppm)) is a prerequisite for successful nursery raising. Pre-sowing operations *viz.,* deep ploughing, bed cutting and post sowing operations *viz.,* mulching, regular watering (4 times a day) and weeding, pest and disease control measures are essential in conventional nursery which is costly and requires the good amount of natural resources. Application of water and weeding are labour intensive and there will be Shortage of labour due to its seasonality. Seedlings are ready for transplantation in 70-75 days.

Disadvantages associated with conventional nursery raising was (i) Seedlings will experience transplantation shock and hence more gap fillings as a result the crop growth will not be uniform (ii) Water and fertilizer use efficiency will be less (iii) Weeds are major problem (iv) Incidence of pests and diseases more (v) Total mandays for seedling production is high (vi) cost of production of seedlings is high.

Poly Tray Seedling Production:

A tray nursery technique has been developed and standardized to produce healthy tobacco seedlings to overcome disease problems and to preclude transplantation shock. The technique is simple and entails sowing tiny tobacco seeds on coconut coir pith compost and transferring the young seedlings of about 20-25 days to poly-trays for raising them on the growth media with standard nutrient and watering schedules. The tray nursery seedlings take about 60-65 days from sowing to transplanting. Tray nursery seedlings offer the unique advantage of ensuring crop uniformity with minimum gap fills and consequently increased cured leaf yield and quality as against the seedlings grown under conventional raised soil-bed nursery.

Mother trays : In tray seedling production unlike in conventional method, seedlings are raised on composted coir pith medium (coir pith alone or coir pith + FYM (3:1)) in mother trays (cement bins/trays/brick beds) for about 25-30 days under protected condition. Coir pith medium is to be fortified with single super phosphate @ 300 g of single superphosphate, 250 g ammonium sulphate, 150g potassium sulphate/100kg. Spraying of blitox @ 2g/l on the medium is be done as a precautionary measure to avoid soil born diseases. In these Mother trays sand is added at the bottom and only top 4" is to be filled with the coir pith medium. Before sowing lines are to be made with broomstick on the media and the seed is sown @ 0.4 -0.6 g/sq mt. Water application is to be done in the initial stage with sprayer two times a day. Excess watering is to be avoided. Seeds start germinating from 5Th day onwards and the germination will be completed by 7-8 days. Fertiliser spray with 10g each of Ammonium sulphate/CAN and potassium sulphate/10 litre is to be given two times @ 10 days interval after sowing. Seedilings will be ready for transplanting the trays by 20-25 days.

Resetting in trays: Fortified coir pith is to filled tightly in the cells by periodical pressing in trays of 70/98 cells. Before filling coirpith is to be moistened by applying required quantity of water so that filling is easy. After filling, the trays seedlings of 20-25 days are planted in the trays by making a suitable hole using a nail or small stick. After planting the media around the seedling is to be pressed. After resetting, the trays are to be kept in shade for 3-4 days. After that the trays are shifted to the raised beds in shade net (50%). Fertilisers are to be given three times at 5,20 and 25-30 days @ 100 ml,200ml and 300 ml of N and K (50g of CAN + 50 g of Sulphate of potash in one litre) in 10 litres rosecan/ 40 trays. Washing of the seedlings is to be done after fertilizer application. Three days after third dose of fertilizer application seedlings are to be kept outside shade for about 7 days for hardening. Thus healthy seedlings will be ready after 60-65 days. At this stage when it is pulled seedlings will come easily from the tray because the coir pith is covered by the root mass. Clipping can be done if the field conditions are not ready for planting. Three to four days before transplanting ridomil @ 2.5 ml/10 litre and Flue bendamide @ 20g/1o litre is to be sprayed to avoid subsequent mortality in the main field due to the incidence of leaf blight and stem borer.

Advantages of tray nursery

- 100% establishment, improves the yield by 10-25%
- Uniform crop growth due to less gap fillings (<1%), no transplantation shock, Uniform field operations viz., topping and harvesting.
- No Weed problem in tray nursery
- Water and fertilizer use efficiency will be more. Hence, seedlings can be raised even under water scarcity.
- Pests and diseases Incidence very less.
- Farmer friendly technology: Can be performed in back yards unlike conventional nursery
- Tray seedlings improves moisture and nutrient holding capacity and the soil health
- Higher net returns and cost benefit ratio.
- Total man days for seedling production less
- Crop duration will be reduced by 10 days
- Reduces the pest and disease incidence in main field
- Total cost of cultivation reduced

Extent of Adoption: Front line demonstrations and training programmes were conducted to farmers and stake holders at different locations. In collaboration with tobacco board, sensitization programmes were conducted through Field Friends programme. More than 80% farmers in Northern Light soils of Andhra Pradesh and 90% farmers in Karnataka light soils adopted the technology.

Yield : Tray seedlings enhances the FCV tobacco yield by 10-25% depending on the growing conditions.

Economics : The cost of production for 1 lakh seedlings in conventional nursery is Rs. 55,000/- whereas in tray seedling production it is Rs. 33,000/-. The net profit in raising the tray seedlings is Rs. 22,000/- per 1 lakh seedlings apart from considerable saving in irrigation water.

Drip Fertigation: A Tool for higher Yield, Water and Nutrient Use Efficiency

Drip fertigation, ensures the efficient use of nutrients, fertilizers, environmental protection and better economics of tobacco production. Ferigation with tray seedlings will further enhance the yield and quality of FCV tobacco.

Tobacco as a commercial crop has unique place in India, as it generates substantial amount of about Rs 23,318 crores to the national exchequer in terms of excise revenue and foreign exchange of Rs 6058 crores. Tobacco is grown under different agro-climatic conditions *viz.,* monsoon and also in post rainy season under conserved soil moisture. It is grown under irrigated (furrow irrigation) conditions in West Godavari and East Godavari districts of Andhra Pradesh and Khammam district of Telangana to an extent of 28,000 ha. As the soils are light textured (sands and sandy loams) in this zone, water and nutrient use efficiency are low with furrow irrigation.

DRIP IRRIGATION

New irrigation technologies, such as drip irrigation to grow tobacco, not only enables the efficient use of every drop of applied water but also leads to enhanced crop growth and yield. This is due to maintenance of uniform soil moisture regime in the crop root zone by way of frequent irrigations at shorter intervals. Besides irrigation, a major component of profitable tobacco production is sound and balanced fertilization. Fertigation i.e., application of fertilizers via irrigation system i.e. Drip fertigation, ensures the efficient use of nutrients, fertilizer conservation, environmental protection and economics of tobacco production. In addition, fertigation with tray seedlings for healthy and uniform seedlings will enhance the yield and quality of FCV tobacco apart from higher water and nutrient efficiency.

Drip irrigation with Recommended Doses of Fertilizers (RDF) in FCV tobacco proved its superiority over furrow irrigation with RDF. Drip irrigation with RDF recorded increased green leaf yield by 16%, cured leaf yield by 18% and grade index by 15% per hectare when compared to furrow irrigation with RDF.

DRIP FERTIGATION

Drip fertigation with 100% RDF proved its superiority over Drip irrigation with RDF and furrow irrigation with RDF. Drip fertigation with RDF recorded increased green leaf yield by 27%, cured leaf yield by 12% and grade index yield 11% when compared to drip irrigation with RDF. When compared to furrow irrigation with RDF, the green leaf yield increased by 47%, cured leaf yield by 32 % and grade index by 28% per hectare. Drip fertigation with 80% RDF recorded yields comparable to Drip fertigation with 100% RDF and significantly higher than drip irrigation with RDF and furrow irrigation with RDF there by saves fertilizers to an extent of 20%.

TRAY SEEDLINGS WITH DRIP FERTIGATION

Planting of tray seedlings proved advantageous compared to conventional seedlings in terms of early establishment, uniformity of growth, duration and productivity. The tray seedlings with drip fertigation plot recorded increased green leaf yield by 18%, cured leaf yield by 16% and grade index yield by 24% per hectare when compared with conventional seedlings and furrow irrigation. The additional profit accrued due to tray seedlings and drip fertigation was Rs 25,285/- per ha with a B: C ratio of 1.823. In addition to the monetary benefits, total irrigation water requirement is only 57.2% of total furrow irrigation water requirement, thus showing 42.8% saving in irrigation requirement. The water use efficiency values for tray seedlings with drip fertigation and conventional seedlings with furrow irrigation are 11.74 and 5.77 kg CL/ha-mm of water which resulted in 103.5% increase in WUE by using tray seedlings with drip fertigation.

The technology was popularized through front line demonstrations and trainings. Apart from this, the technology was popularized through Tobacco Board and Trade partners (ITC, GPI etc). A total of 15 per cent of farmers adopted this technology in an area of 4000ha. The area under drip irrigation-fertigation is steadily increasing. Within a next couple of years, drip irrigation and fertigation system will be the prevailing irrigation system in the region.

FCV Tobacco Varietal Development

Tobacco is a low volume high value commercial crop grown in India. Among the different styles of tobacco cultivated in the country Flue Cured Virginia tobacco belongs to exportable type and has lion share in total tobacco exports. Indian FCV tobacco has unique demand in the international market as price competitive natural neutral filler to semi flavorful tobacco. Cost escalation in FCV tobacco production over the years has resulted in gradual reduction of farmers' net income. Hence, in order to the sustain the competitive edge in the international market and to enhance the monitory benefits accrued to the farmers, there is a need to enhance the productivity of FCV tobacco.

During the last five years, with the objective of increasing and stabilizing the yield levels and enhancing leaf quality with reduced harmful substances two FCV hybrids and 3 FCV varieties were released for commercial cultivation. Further one FCV cultivar and two Chewing cultivars were identified for release. The salient features of these cultivars are furnished below.

S.No	Variety	Year of release	Recommended areas	Productivity (kg/ha)	Salient traits
	Flue-cured tobacco				
1.	FCH 222	2012	*Fusarium* wilt endemic Light Soils of Karnataka (KLS)	3,000	Suitable to. Has high degree of tolerance to *Fusarium* wilt disease
2.	CH-1	2015	Northern Light Soils (NLS) areas of Andhra Pradesh	2,900	Flavourful hybrid
3.	N-98	2015	Andhra Pradesh	2,200	Rainfed conditions of Southern Light Soils
4.	LT Kanchan	2015	NLS areas of Andhra Pradesh	2500	Low tar yielding
5.	CH-3	2016	KLS of Karnataka	2,700	Flavourful hybrid
6.	TBST-2*	2014	Black Soils and Southern Light Soil areas of Andhra Pradesh	3300	Aphid tolerant and TMV resistant

* Identified for release

- FCH 222: It is a *Fusarium* wilt tolerant variety having an yield potential of 3000 kg/ha released for cultivation in light soil region of Karnataka. Since its inception, the variety has been cultivated and witnessed a steady progress covering majority of wilt endemic area, at present it is being cultivated in around 6000 ha in KLS.

- **LT Kanchan :** A low tar (less by 10%) flue-cured Virginia tobacco variety with high yield potential of 2,500 kg/ha is suitable for commercial cultivation in the Northern light soil region covering West Godavari district of Andhra Pradesh. Low tar content (harmful smoke constituent) in cured leaf biomass is the special trait associated with this variety.

- **CH-1:** A CMS based flue-cured Virginia tobacco hybrid is released for commercial cultivation in the Northern light soil region of AP. This hybrid is known for its high yield potential (2900 kg/ha) as well as its superior leaf quality in terms of smoke flavor resulting from relatively higher concentration of neutral volatile compounds.

- **N-98:** A high yielding (2,200 kg/ha) FCV tobacco variety is suitable for commercial cultivation in Southern Light Soils region of Andhra Pradesh. It is the most prefered tobacco variety in the recommended area and currently being cultivated in about 3000 ha in SLS/ SBS areas of Andhra Pradesh.

- **CH-3:** A high yielding (2500 to 2700 kg/ha) FCV tobacco hybrid suitable to Karnataka light soil FCV tobacco growing areas. CH-3 recorded significantly higher values of flavour causing neutral volatile compounds than the check variety, Kanchan. It is steadily replacing the varieties grown in light soils of Karanataka and Andhra Pradesh (NLS). At present it is cultivated in 17000 ha (including 22% of KLS and 80% of NLS).

- **TBST-2** : High yielding FCV tobacco variety TBST-2 is identified for its resistance / tolerance to TMV and aphid infestation. It is suitable for cultivation in Southern Light Soils and Black Soils regions of Andhra Pradesh. In view of its higher yield and pest tolerance, its gaining popularity among the farmers.

Impact of the released varieties/hybrids:

- The released varieties/hybrids during the period have occupied around 20% of the FCV tobacco growing areas replacing the existing cultivars.
- The average FCV tobacco productivity was increased from 1205 kg/ha (2010-13) to 1394 kg/ha (2013-16), witnessing an increase of 189 kg/ha depicting the inevitable contribution of released varieties/hybrids during the period.

INSECT BAIT: AN ECO FRIENDLY PESTICIDE APPLICATION FOR MANAGEMENT OF TOBACCO CATERPILLAR

Baiting technology will avert or abviate blanket application of insecticides and contribute in reduction in pesticide pollution due to drift and water pollution. As the insecticides used are low a.i. and relatively safe to the non target organisms and beneficial are not affected. The baiting technology helps in minimising the pesticide residues in the end product which is a cause of concern for commodities like tobacco, chillies and other agricultural products meant for export purpose.

Preamble

Spodoptera litura is a serious polyphagous pest in India and attacks various crops *viz.*, tobacco, groundnut, chilli, pulses, cotton, sunflower, soybean and several vegetable crops. Farmers heavily depend upon chemical control to protect the crop from the pests resulting in negative economic as well as ecological consequences. Indiscriminate use of synthetic insecticides has led to development of resistance in the pests, destruction of beneficial organisms, resurgence of insect pests and pesticide residues in agricultural produce leading to health hazards. Due to a combination of factors the frequency of pest control failures has increased and high pesticide input based agricultural technology has led to poor economic returns. Insecticide baits are popular among farmers and are used under out break situations and cyclonic weather conditions that prevail during November to January with cloudy weather and continuous rains. Under such situations foliar sprays are ineffective and insecticide baits have been recommended for management of the pest. However, the baits with chemical insecticides *viz.*, chlorpyriphos, monocrotophos and carbaryl are not eco-friendly and pose a hazard when used indiscriminately. Under such situation the baits with new low a.i and relatively safe insecticides go a long way in protecting these crops from the ravage of the polyphagous pest *Spodoptera litura* and help in realising the potential yields and contribute to the national economy.

Technology

Insecticide bait with rice bran + Jaggery + water

Insecticides (Emamectin benzoate 5 SG, lufenuron 5 EC, novaluron 10 EC,) baits were prepared with rice bran + jaggery + water, against *S.litura* on FCV tobacco. Emamectin benzoate bait treated plots recorded least infestation both at 4 (4.60 %) and 10 (4.80 %) days after treatment (DAT). Novaluron baited plots recorded 5.40 & 6.00 % infestation whereas, lufenuron bait treated plots recorded 6.60 7 6.80 per cent infestation at 4 & 10 DAT, respectively, compared to the untreated plots (16.20 and 20.80 per cent infestation). Emamectin benzoate provided maximum protection to tobacco leaves as shown by less number of leaves damaged (1.26 & 1.40), similarly, by novaluron (1.86 & 2.20) and lufenuron (2.10 & 2.50) baits as compared to control (5.26 & 6.40) both at 4 and 8 DAT respectively. Based on the results, baits prepared with Emamectin benzoate bait and IGRs, novaluron and lufenuron can be used instead of chlorpyriphos bait in tobacco field crop.

As regards leaf area damaged at 4 DAT, emamectin benzoate recorded least leaf area damaged (2.19 %) followed by novaluron (3.16 %) and lufenuron (3.40 %) and all these were significantly less to untreated control (10.2).

Economics

Emamectin benzoate bait treatment recorded highest cured leaf yield (1982 kg/ha) and net returns (Rs 1,39,966/ha) with an ICBR of 1:16.28 where as novaluron and lufenuron bait treated plots recorded 1931 & 1812 kg cured leaf yields per hectare with net returns of Rs 1,34,203 & 1,20,756 and ICBR of 1:14.83 and 1:11.48 respectively.

Advantages

- The baiting technology will avoid blanket application of insecticides and contribute in reduction in pesticide pollution due to drift and water pollution.
- As the insecticides used are low a.i. and relatively safe to the non-target beneficial organisms.
- Baiting technology helps in minimising the pesticide residues in the end product which is a cause of concern for commodities like tobacco, chillies and other agricultural products meant for export purpose.

HIGH YIELDING ROOT-KNOT RESISTANT BIDI TOBACCO VARIETY - ANAND BIDI TOBACCO 10 (ABT 10)

A high yielding root-knot resistant *bidi* tobacco variety - Anand *bidi* tobacco 10 (ABT10) was released for irrigated conditions under middle Gujarat. The variety registered 31 and 6% increase in yield in farmers' field over A 119 (root-knot susceptible variety) and GT 5 with similar quality parameters and exhibited resistance to root-knot disease in controlled, sick plot and field conditions at BTRS farm and also on farmers' fields at different villages of Gujarat.

Root-knot resistant ABT 10 | **Root-knot susceptible A 119**

ABT 10 & A 119 varieties in root-knot sick field at Vanoda Village

Varietal characters : The variety has shy suckering habit, thick bodied and better smoke taste than GT 5, with low incidence of other diseases and tolerant to wet-footing under nursery. Without any additional cost, ABT 10 variety reduced root-knot disease by 100% in first year. Planting of ABT 10 (RKI, 0.00) consecutively for six years in severely root-knot infested field (RKI, 2.99) found to reduce the disease by 77% in seventh year. This resulted in 526% increase in yield over the susceptible variety A 119 in sick field under farmers condition, fetching an additional income of Rs. 1.50 lakhs /ha.

The technology is recommended in the endemic areas of the root-knot disease.

HIGH Yielding BIDI TOBACCO VARIETY: GUJARAT ANAND BIDI TOBACCO 11

In Gujarat *bidi* tobacco is cultivated in an area of 1,50,000 ha. Maximum area (90%) is concentrated in middle Gujarat under irrigated conditions. At present GT-7 (45% area), A 119 (40% area) and MRGTH 1 (15%) are the important varieties occupied maximum area in the middle Gujarat.

Varietal characters: A high yielding (4175 kg/ha), thick bodied, shy suckering variety with better smoke taste. On an average GABT 11 has given 86.6 and 10.5 *per cent* higher yield than existing varieties A 119 and MRGTH 1, respectively under irrigated conditions at BTRS, Anand. It is comparable to MRGTH 1 in chemical constituents.

	
GABT 11	**Field Crop GABT 11**

Economics

- ✓ Increase in yield by about 86% (4175 kg/ha) over A 119 (2275 kg/ha) variety on research farm
- ✓ Increase in monetary return by more than Rs. 95,000/ ha.
- ✓ GABT 11 showed 33% higher cured yield (4480 kg/ha) over ABT 10 (3360 kg/ha) which ultimately fetched monetary return about Rs. 56,000 to the farmer
- ✓ Land can be spared for other food crops
- ✓ No additional input cost.
- ✓ Reduction in labour cost due to shy suckers