

Alternative Uses of Tobacco:

Conventionally tobacco is used in the manufacture of cigarettes, bidis, chewing mixtures, cigars, cheroots, hookah tobacco paste, snuff, gutka, zarda and quiwam. However, tobacco is an excellent source of photochemical having pharmaceutical, agricultural and industrial importance. Thus, alternatively, tobacco can be the source for extraction of nicotine, an alkaloid, solanesol, a trisesquiterpene alcohol and organic acids (malic and citric). Apart from these chemicals, there are other possibilities such as protein recovery from green leaf, oil from seed, rutin (Vitamin P) from cured leaf and furfural (industrial solvent) from stalk.

Nicotine: A bench-scale technology, employing ion-exchange resins, was developed for recovery of 40% Nicotine sulphate. The product was tested and found to be effective in controlling different pests attacking various crops, particularly its action on Brown plant hopper (BPH) and Green leaf hopper (GLH) damaging paddy is note worthy. As nicotine sulphate is banned in the country for internal consumption as pesticide, commercialization of the technology has not taken-off. Recent scientific evidence suggests that nicotine and nicotine like compounds may slow or ameliorate the symptoms of certain diseases like Tourette's syndrome, Alzheimer's, Parkinson's disease, Ulcerative Colitis and Attention Deficit Disorder (ADD).

Solanesol: A bench-scale technology was developed for recovery of solanesol 95+%. The collaborative programme with Central Drug Research Institute, Lucknow has established the possibility of synthesizing new bioactive compounds, starting from solanesol, which could lead to new drug development. There is considerable interest among the entrepreneurs in the technology and after obtaining the patent, the technology will be transferred as per ICAR guidelines. Patent application is being filed for "Process for purification of solanesol (95+%) from crude/enriched extracts of tobacco green leaf/cured leaf/tobacco waste".

Solanesol has been a starting material for synthesis of Vitamin K2 (antherorrhagic vitamin), Vitamin E (anti-sterility vitamin) and Coenzyme Q10 (physiologically active substance with high pharmaceutical activity against cardiac insufficiency, muscular dystrophy, anemia etc.). As per the latest findings in the literature, Japanese scientists have used the solanesol derivative, Nsolanesyl-N, N1-bis (3,4-dimethoxy benzyl) ethylenediamine for potentiation of anti-tumor drugs. CTRI will be conducting research in collaboration with Central Drug Research Institute, Lucknow under the project "Synthesis and biological evaluation of solanesol derivatives as novel bioactive substances" The project sanctioned by the Indian Council of Agricultural Research (ICAR), New Delhi, with an outlay of Rs.27.08 lakhs will undertake testing of solanesol derivatives for hypolipidaemic, anti-tubercular, wound healing and anti-oxidant activities.

Organic acids: Crude organic acid fraction containing malic acid and citric acid obtained as an effluent in the nicotine recovery process was found to be effective in solubilising Rock phosphate. Apart from utilization of tobacco waste, the possibility of growing tobacco for recovery of phytochemicals is also being explored at CTRI. It is estimated from this study that 380 kg of crude protein, 97 kg of 40% nicotine sulphate, 18 kg of 95+% solanesol and 56 kg of seed oil could be recovered from the crop grown in area of one hectare. If tobacco is to be exclusively grown for alternative uses (extraction of chemicals) farming practices are to be modified to optimize the levels of the chemicals and CTRI has already initiated work in this direction. Generally, flue-cured Virginia (FCV) tobacco is a better source for extraction of solanesol and air-cured tobaccos like bidi, natu & chewing are ideal for recovery of nicotine and organic acids. It has been identified that chewing tobacco variety 'Abhirami' and HDBRG tobacco are good sources for both nicotine and solanesol. Nicotine sulphate (40%) and solanesol (95+%) have good export potential. Hence, to exploit the immense economic potential, evolving proper marketing systems for the chemicals and their value added products is essential to sustain tobacco production. The seed oil content in tobacco seed estimated to vary from 35-39%. Nutritional quality of tobacco seed oil, free from nicotine, is found to be better than groundnut, mustard and cotton seed oils, on par with sunflower seed oil which is being considered as best for heart patients. The potential of tobacco as an oil seed crop is firmly established with the possibility of production of 1171 kg/ha seed

with a recovery potential of 433 kg/ha oil from a chewing tobacco crop (Var. A-145) with modified agro techniques.

Integrated Barn

In case of FCV tobacco, 30% of cost of cultivation goes for curing of tobacco. To minimize curing costs several efforts were made for energy conservation. To evaluate the combined efficacy of different energy saving techniques, an “Integrated barn” was designed with low profile barn + ventury furnace + ceiling insulation with paddy straw + modified flue system and tested at CTRI Research Station, Hunsur during 2001 season. The mean fuel use from seven curing tests was 2.43 kg wood per kg cured leaf, giving a fuel saving of about 51% over the absolute control barn of 16' x 16' x 16' size (without any energy saving modifications). The significant decrease in wood fuel use in this model integrated barn is due to the combined effects of efficient burning of wood fuel, minimization of heat loss, retention of heat generated for longer time and better heat transfer inside the barn. The integrated barn, with its high energy saving potential, can drastically minimize the fuel requirement for flue curing of tobacco in the states of Karnataka and A.P., the major FCV tobacco producers of the country. Without altering the size of their barns, the small and marginal farmers can easily adopt ventury furnace, modified flue system and ceiling insulation at a combined investment of Rs.9,500 to Rs.11,000/- per barn depending on size, and can recover this cost in 10 to 12 curings, spread over two seasons. In addition to the monetary benefits, integration of energy saving modifications will also reduce the total fuel requirement for flue curing. Popularization of the energy efficient barn coupled with the alternative fuels like coffee husk, briquettes, coconut halves and other agricultural waste will significantly reduce the consumption of wood for curing of FCV tobacco.

Banana Fibre Extractor:

The Krishi Vigyan Kendra of Central Tobacco Research Institute has designed and developed a machine called “Banana Fibre Extractor” for extraction of fibre from pseudo stems, leaf stalks and peduncle of banana. The machine is first of its own kind in this field, developed for the commercial exploitation of unutilized banana waste. The

machine consists of a rigid frame on which the roller rotates. The roller consists of horizontal bars with blunt edges. The roller is connected to one HP motor by belt pulley mechanism. The machine is driven by one HP single phase electric motor (220 v). Adjustable guiding rollers are fitted for feeding purpose. Safety precautions like pulley guards are incorporated in the machine. The machine reduces drudgery and increases the fibre production fifty times compared to manual process. It is user friendly and economical with less maintenance cost and safe to operate. Superior quality fibre in terms of length, softness, strength and colour, can be obtained with this machine. The machine helps banana cultivators to get additional income through economic utilization of the hitherto unutilized portions such as pseudo stems, peduncle and leaf stalk. An additional income of Rs 2500/ acre is assured to the banana cultivators. There is heavy demand for this machine from different parts of the Country. The manufacturing rights were given to AP Agro Industries Corporation, Hyderabad. In the current World Scenario, the banana fibre is being extensively used as a blending material in textile industry in countries like Philippines, Malaysia, Manila, Japan and Korea. Being a natural fibre it easily blends with other fibres such as Jute and Mestha. Therefore industrial products like gunny bags, door mats, carpets, yarn, rope, geo textiles, travelites, luggage carriers and interior decorative items can be made out of this fibre. The USA being the main importer of banana fibre, the export of fibre will earn considerable foreign exchange to our country.

Palmyrah Fibre Separator:

The extraction of fibre from the fronds is one of the important rural and tribal cottage industries in the coastal districts of Andhra Pradesh, Tamilnadu and parts of Kerala. Palmyrah fibre is the product obtained from the fronds (leaf bases) of Palmyrah trees. More than 30,000 families belonging to scheduled castes and tribes community are depending on this fibre industry for their livelihood. Our country is earning more than 100 crores of foreign exchange every year through this rural cottage industry. Traditionally fibre separation is a very tedious and cumbersome process, which includes heavy drudgery. A family comprising of 4 to 5 members can hardly produce 5 to 6kg of fibre per day earning about Rs.50/- to 60/- only. The rural and tribal poor who are the main pillars of this industry are hardly earning for their livelihood. The heavy drudgery

causes ill effects to the rural and tribal poor. The bodies of the children get deformed at chest and shoulders level. The middleaged men get chest pains, arthritis, respiratory disorders etc. An in depth survey in this particular industry was conducted by this Kendra and found that introduction of suitable technology and mechanization is a must to reduce the drudgery and to make the profession much more attractive by improving per day income and healthy aspects.

Mechanization was introduced for the first time in the History of Palmyrah Fibre Industry by this Kendra, a machine PALMYRAH FIBRE SEPARATOR and a combing device was designed and developed in the year 1997 and 1998 respectively. The enthusiasm of the rural and tribal people especially from tribal women towards mechanization of this trade is very much encouraging. Taking the advantages of both the machines made earlier finally a machine called New Palmyrah Fibre Separator was designed and developed by this Kendra as per the desire of the Tribal and rural women. The women groups in the rural and tribal areas received these latest machines under IFAD project with 75% subsidy through ITDA. Presently these women groups are producing 50 to 60 kg fibre per day and earning Rs.500 to Rs.900 of net income per day. Further they are also processing the fronds of others those who have not received the facility by charging @ Rs.3/- per kg fibre.

The Government and Non-Government organizations like DRDA, ITDA, Forest departments and Voluntary organizations involved in rural and tribal development activities supplied these machines to the needy people with 50 to 75% subsidy. Presently more than 250 machines were in operation in East and West Godavari districts of A.P. This machine brought a revolutionary change in the lives of rural and tribal poor who are depending in this field of palmyrah fibre for their livelihood. On its initial success in the Andhra Pradesh, the machine is now becoming popular in the coastal belt of Tamil Nadu and Kerala.

Revolving Fund Scheme on Tobacco Seed and Seedling

Introduction

Tobacco is an important commercial crop cultivated in 0.4 million ha producing 700 million kilos of leaf annually. As in other crops, raising uniform crop is essential to obtain higher yields and superior quality tobacco. Use of pure seed of recommended varieties can easily ensure high yields and quality. Keeping this in view, Central Tobacco Research Institute (CTRI), Rajahmundry has started producing and distributing the pure seed of approved tobacco varieties to the farmers since 1952. In view of the purity and quality of the seed produced by CTRI, the demand for tobacco seed supplied by CTRI has



steadily increased over the years. Mean while, in 1956, a scheme was sanctioned to CTRI during the 2nd five-year plan for the production and distribution of pure seed and healthy seedlings of tobacco to farmers. The scheme was continued in 3rd five-year plan also as a committed expenditure scheme under developmental activity and later it was merged with the Institute's main programme from April, 1978 on wards.

Origin of Revolving Fund Scheme

In view of popularity and efficiency of the seed production programme of CTRI, the Indian Council of Agricultural Research, in 1990, has sanctioned a "Revolving Fund Scheme" (RF Scheme) to CTRI with the objective of supplying pure seed and healthy

seedlings of approved tobacco varieties to growers to improve the yield and quality of flue-cured tobacco.

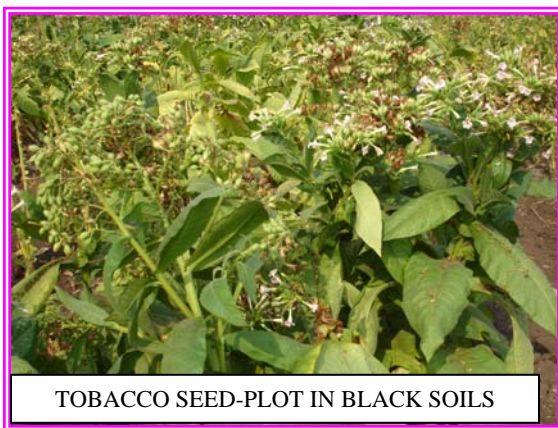
CTRI has created the Seed Production Section for efficient running of the RF scheme. Under regular supervision of the Director, CTRI and Seed Production Officer of the Section, a dedicated team of scientific / technical staff are working for the production and supply of pure seed to the farmers.

RF Scheme: A Model for Emulation

Usually, nearly 18,000 to 20,000 kg of FCV tobacco seed and 400-600 kg of Lanka tobacco seed (Non-FCV) are produced and distributed to the tobacco growers in Andhra Pradesh. CTRI adopts a novel methodology for the production of this huge quantity of pure seed. Every year, Seed Production Section raises tobacco nursery in an area of 2.25 ha and supply the healthy seedlings @ 30,000/ha to 130-150 seed plot growers of East Godavari and West Godavari district of A.P. Further, seedlings are also supplied to gap fillings, if necessary, in order to optimize the plant stand for achieving higher seed yields. Progressive farmers are chosen to raise the seed plots to maintain seed purity. In general seed plots are selected on the basis of their nearness to the Institute, willingness of the farmers and suitability of the variety to the region. The seed plot farmers are given a subsidy of Rs. 500/ha besides free supply of seedlings for planting and gap filling.

Seed-Plot Maintenance and Seed Collection

The seed-plots are planted directly under the supervision of the Seed Production Section staff. Adequate isolation distance (3.0 m) is maintained while planting seed plots. In general, 200-225 ha of seed plots are raised in East Godavari and West



Godavari districts. The plots are regularly monitored by the plant breeders and necessary instructions are given to the farmers for raising the healthy crop. The plots are regularly rogued to remove the off-types once at the grand growth



stage and the second at the flowering stage to avoid varietal contamination. As the leaf is the commercial product, the farmers harvest and market the leaf and get the price for their leaf

produce. At the end of the season, CTRI staff collects the seed capsules and bring them to the main Institute. These capsules are dried, in the hot summer sun. Threshed and winnowed to remove debris. The seed are later thoroughly dried to maintain seed moisture level below 4.0%, treated with insecticide and packed into half kg polythene sachets. Germination tests are conducted at regular intervals and only the tobacco seeds having more than 90% germination are sold to the farmers.

Scope of RF Scheme



Under the 'Revolving Fund Scheme', the institute produces seeds of recommended FCV and Lanka tobaccos varieties. The quantity of seed production depends on the demand of the individual variety. During the 2007-08, FCV varieties, 'Siri, Hema and VT 1158' are having very good demand. Non-FCV variety 'Lanka Special' seed production and distribution is more or less stable as the lanka tobacco is cultivated in a limited area. Though the 'RF Scheme' was initially started with Rs 3,00,000/- in 1990, receipts of the RF scheme are Rs. 75,00,000/- during 2007. This phenomenal achievement is the testimony for the dedicated and relent less efforts of CTIRI in the seed production arena.



Advantages of RF Scheme

As the seed plot farmers are not losing the economic product, farmers coming forward to take up seed plots. In view of this, our cost of seed production is very low as compared to other FCV tobacco producing countries in the world. At this juncture it is worthwhile to mention that the cost of one kilogram of FCV tobacco seed in Brazil is \$3,000/- while we sell at \$10 per kilogram of seed to our farmers. Further, tobacco

seed is not covered in the Seed Act. Hence, CTRI produces foundation seed and distributes the same to the growers. As private companies are not involved in the seed market, CTRI takes up the responsibility of supplying the pure seed to the farmers. In any given season, more than 90% of the tobacco crop area is planted with the tobacco seed supplied by CTRI particularly in Andhra Pradesh.

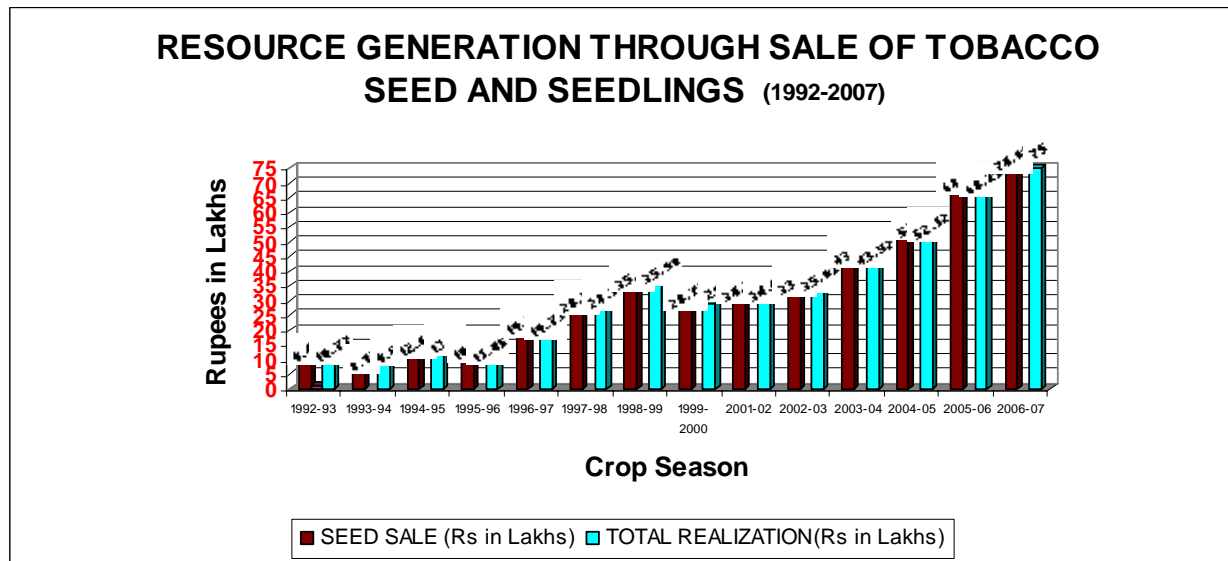
The service rendered by the Institute, to the farming community in seed production aspects is paying richer dividends in terms of uniform crop growth and higher leaf yields. The tobacco farmers are also appreciative of the contribution of CTRI in the production of quality tobacco seed and seedlings.

Trends in seed production since 1990:

Year	Seed plot area (ha)	Seed production in Kg	Nursery area in ha	Seedlings production	Seed sales Rs.	Seedlings sales Rs.	Total Rs.
1990-91	182.16	19,850	-	-	-	-	1028037
1991-92	-	11,322	-	1,18,84,000	-	-	-
1992-93	217.98	17,562	2.29	1,45,39,500	9,44,565	1,33,155	10,77,720
1993-94	147.95	27,201	2.00	99,36,700	8,13,070	1,54,765	9,67,835
1994-95	127.92	19825	2.00	68,65,000	12,63,539	37,870	13,01,409
1995-96	219.78	5445	2.20	96,56,000	10,78,555	66,480	11,45,035
1996-97	226.7	16689	2.2	96,84,000	19,38,642	34,750	19,73,390
1997-98	218.60	19,781	2.20	97,68,000	28,53,500	17,610	28,71,111
1998-99	232.40	38,261	2.20	92,29,000	35,62,933	37,060	35,99,993
1999-00	226.60	15,981	2.42	82,23,000	28,77,514	23,050	29,00,564
2000-01	Crop Holiday in Andhra Pradesh and hence, no seed production						
2001-02	239.4	30,250	2.35	87,99,000	34,33,000	28,039	34,61,039
2002-03	180.0	15,507	2.00	70,69,000	33,94,540	1,09,000	35,03,540
2003-04	185.0	16,000	2.00	50,00,000	43,19,847	32,780	43,52,627

2004-05	191.0	18,507	2.00	60,27,000	52,00,000	12,500	52,12,500
2005-06	149.0	18,800	2.00	67,10,000	68,17,274	8,000	68,25,724
2006-07	195.0	20,000	3.0	78,76,500	74,85,500*	14,200	75,00,000*

*: Estimated, seed sale is in progress



SIRI

Siri", a high yielding and superior quality Flue-Cured Virginia (FCV) tobacco variety was released by the Central Tobacco Research Institute (CTRI), Rajahmundry for cultivation in the rainfed Vertisols of Andhra Pradesh during 2006-07 crop season, which performed very well under farmers field conditions in Black soils of Andhra Pradesh with an average yield of 3000 kg/ha-an yield of 1000 kg higher than the existing cultivars in Black soils. It is estimated that an additional production of 10 million kilos was obtained during 2006-07 season due to the cultivation of this variety. Trade, farmers and Tobacco Board have impressed with the performance of Siri cultivar under field conditions. During 2007-08 season, the demand for Siri seed was unusually high. During 2007-08 season, this variety is expected to occupy 30,000 ha out of 40,000 ha of Black soil in Andhra Pradesh.

MEENAKSHI (CR)

A caterpillar resistant chewing tobacco variety Meenakshi (CR) was released during 2007-08 for cultivation in the Inland chewing tobacco tract, i.e. Southern, Central & Western chewing tobacco zones of Tamil Nadu under irrigated conditions. It has an yield potential of around 3500 kg/ha with added resistance to *Spodoptera litura*.

ALTERNATIVE CROPS TO TOBACCO

Intensive research work has been carried out to identify the remunerative alternative crops to tobacco. None of the alternative crops tested under mono cropping system are as remunerative as tobacco in almost all tobacco growing areas. Some of the alternative crops identified are maize and sugar cane in Northern light and Black soils of Andhra Pradesh; red gram and maize in Central Black soils; Black/green gram and sunflower in Southern Black and light soils; cotton and maize and ragi in Karnataka light soils; turmeric and sugarcane and sunflower in chewing tobacco areas of Tamil Nadu; potato, garlic mustard in Bihar; Aman rice, aus rice and mustard in West Bengal; mustard, ground nut and chilies in Gujarat; potato, wheat and bhendi in Uttar Pradesh and Chickpea, sunflower and jowar in Natu and Bidi tobacco areas of Andhra Pradesh.

CROPPING SYSTEMS ALTERNATIVE TO TOBACCO

Inter cropping trials and cropping sequence studies have clearly indicated that net returns accrued by growing two or more crops are higher than the returns obtained from sole crop of tobacco. Remunerative cropping systems to tobacco are given below.

Type of tobacco and zone	Remunerative cropping systems
FCV tobacco – Northern Light Soils (NLS)	Redgram+groundnutgreengram/ summer vegetables or Groundnut + Maize –Greengram
FCV tobacco – Northern Black Soils (NBS)	Rainfed agro-eco system: Maize- Bengalgram Irrigated agro-eco system: Sugarcane (Mono crop)
FCV tobacco – Central Black Soils (CBS)	Soybean + Redgram or Maize -

	Redgram
FCV tobacco – Southern Black Soils (SBS)	Fallow-Bengalgram or Jowar-Mustard
FCV tobacco – Southern Light Soils (SLS)	Groundnut - Redgram
FCV tobacco – Karnataka Light Soils (KLS)	Cotton – Ragi or Cotton + Soybean or Chillies
Chewing tobacco – Tamil Nadu	Onion – Annual Moringa or Chillies – Annual Moringa
Chewing tobacco – Bihar	Maize - Potato or Potato + Garlic
Chewing tobacco – West Bengal	Jute - Aman paddy – Potato or Jute - Aman paddy – Mustard
Bidi tobacco – Gujarat	Cotton–Groundnut or Castor- roundnut (Summer)
Chewing and Hookah tobacco – Uttar Pradesh	Maize - Potato