(A note prepared by Dr. M.S. Swaminathan
for the consideration of the Panel of
Agricultural Scientists)

..*.*

Possibilities for Export Promotion and Import Substitution through agricultural research

1. Introduction:

A high proportion of India's foreign exchange earnings is contributed by agricultural produce. Nevertheless scope exists for enlarging the spectrum of foreign trade by exploring new avenues in both export promotion and import substitution. In view of the fact that the foundation for a very efficient and effective agricultural research set-up has now been laid in the country, it should be possible to take advantage of our endowment of scientific skill for seduring new types of export markets. Both the exploitation of the work already done as well as the identification of some of the problems, which, if solved through intensive research, would help to promote exports deserve attention. A few such possibilities are indicated in this note.

In view of the fact that the allocation of foreign exchange for the purchase of equipment, books and chemicals for our agricultural research and educational Institutions is very meagre (about rupees five lakhs per year), it would be beneficial if the additional foreign exchange earned through the exploitation of the avenues indicated in this note is made available to the Indian Council of Agricultural Research. Since the practice of providing incentives for export promotion is already being adopted in the case of industry, the allocation of the foreign exchange earned through research to support further research will not be in any way a precedent

Contd...p/2.

If this principle is accepted, the Indian Council of Agricultural Research could offer to earn all of its foreign exchange requirements

2 Export Possibilities:

a) Export of high quality seeds of new hybrids and varieties:

The following are some of the possibilities for the immediate export of high quality seeds:

S.No.	Crop	Variety	Countries to which exports are possible
1.	Jowar	C.S.H.$_1$ and C.S.H.$_2$	Brazil, Argentina, Spain, Italy, Israel, countries in Africa.
2	Maize	Composites and hybrids.	Thailand, Philippines, Italy, Japan, countries in Africa.
3	Bajra	H.B.No.4 and other hybrids.	Countries in Africa.
4	Berseem	Pusa Giant Berseem.	U.A.R., U.S.S.R, Israel, Germany, Netherlands, France and Belgium.

This view is based upon the data obtained from trials carried out with some of our material in other countries (See Tables 1 and 2). The tetraploid strain of berseem (Trifolium alexandrinum, 2n=4x=32) has been tested in the Netherlands and found very green useful as a green manure crop. There is a request from a leading Dutch Seed Company for getting Pusa Giant Berseem entered in the Dutch Approved List of Varieties so that we can become eligible for getting royalty under the Dutch "Plant Breeders' Decree".

The Union Minister for Food & Agriculture has already made an offer in his recent address at the 13th Session of FAO for conducting trials with our new material in different parts of the world through FAO, as per abstract from his speech given below:

"We are happy that some of our maize hybrids are doing exceedingly well in many other countries in Asia. Likewise, our Sorghum hybrids have performed very well

Contd....p/3.

in Brazil and countries in Latin America. I have no doubt that our pearl millet hybrids can revolutionize the yields of this crop in many countries of Asia and Africa. Our strain of Egyptian Clover produced by a feat of chromosome manipulation is in great demand in Europe and Asia. A variety of our tobacco seems to have the most desirable combination of attributes from the point of view of minimising the dangers of lung cancer. I want to use this forum to offer to this world body and to interested governments assistance in the organization of cooperative trials with the best material we have and later to arrange for the supply of large quantities of high quality seeds of the material found suitable by the different countries. We are confident that this form of export trade based upon the utilization of the talents and skill of our scientists will be one of the most agreeable andrewarding forms of International trade".

It would be useful to follow up this suggestion and get our material assessed quickly and arrange for the multiplication of high quality seed specifically for export purposes. The work of producing seeds for export can be done in a special farm which could be attached to the Indian Agricultural Research Institute. The actual business transactions could be carried out by the National Seeds Corporation in co-operation with the State Trading Corporation.

b) <u>New possibilities in tobacco export</u>:

i) <u>Improvement of flue-cured tobacco</u>:- The cessation of Rhodesian tobacco imports by U.K. can be utilized to increase Indian exports. Delcrest, and Hicks which are the most popular Rhodesian varieties are also the predominant varieties in India.

Contdi....p/4.

Chemically, there is little difference between Rhodesian and Indian tobaccos. Actually, the ash content, and pH of Indian tobacco is favourable as compared to the acidic tobaccos (pH 4.4-5.2) of other countries.

The physical characteristics can be improved through increasing the fertilizer dose, controlled irrigation and topping. The body and size of leaf can be substantially improved in areas with light soils as in Ceded Districts, newly reclaimed forest lands of Bastar and neighbouring districts and light soils of Mysore.

ii) Other tobaccos favourable for blending:- Some of the Indian tobaccos like Lanka tobacco are unique in their qualities and chemical composition and the environment in which they are grown. This tobacco is good in aroma, excellent in body, high in pH and ash. Dr. Dawson, a famous U.S. Chemist has recently indicated the possibility of the United States purchasing several million lbs of Lanka tobacco. The annual output of this tobacco is 8 millions kgs. There should be no difficulty in producing larger quantities for export. Rapid screening of the existing material which has considerable genetic variability, and selection of superior genotypes can further augment the yields.

iii) Screening for quality:- The several available new recombinants from crosses involving elite varieties can be rapidly screened for ash content, body, texture, high pH and response to improved agronomic practices. This study can yield results within the next three years.

iv) Controlled curing:- Studies on curing by infrared light have shown that the curing time can be reduced from 7 days to hardly 15 minutes. This would permit saving of time and assure the consistency of quality of the cured product.

Contd....p/5

v) Import substitution:- The quahityy of flue-cured tobacco needed by the Industry can be easily produced within the country and the import of flue-cured tobacco can be stopped.

Also, nearly 40,000 lbs of wrapper tobacco are nee for the Indian Cigar Industry. This can be met by growing Ran r Sumatra andDixie Bright under hessian cloth in less than 100 acres in the Cooch Behar region of Bengal and the mountain slopes in Palni Hills of South India.

c) Jute:

The area and yield under Corchorus capsularis and C. olitorius in the different States are given below:

Area and yield/hectare of Jute in the different St :

State	Area in '000 hectares.	Yield in kg/hectare	% age Jute area unde Capsularis	& Olitori
West Bengal	456.6	1082.1	55	45
Bihar	170.7	825.4	70	30
Assam	131.3	1150.4	75	25
Orissa	54.7	985.1	75	25
U.P.	18.3	1107.9	99	1
Tripura	9.7	1107.9	98	2

If the Capsularis varieties can be replaced soon h either a day-neutral Olitorius or an olitorius-capsularis hyb d it would be possible to increase the jute yield as well as quality very considerably. What is needed is a high yielding strain, which can be sown in February-March and harvested in July and which can stand water-logging as well as good soil fertility. The work already done at the IndianAgricultural R arch Institute indicates that the interspecific hybrids may give en higher yields than olitorius and hence this line of work nee to be intensified immediately.

Contd....p/6.

d) Breeding varieties of guar with a high gum content:

The following is the amount of guar gum export during the quarter April-June, 1965:

Export figures for April - June, 1965

S.No.	Countries to which exported.	Quantities in kgs.	Amount worth in rupees
1.	U.S.A.	2,00,100*	1,61,130
2.	France	20,000*	26,698
3.	Italy	35,040*	45,871

*This quantity is being exported every month since April, 1965.

The varieties from which gum is now extracted are those which are commonly grown as a vegetable and the gum content of these varieties is very poor. There is much scope for the development of varieties with a white colour and high gum content as can be seen from the work done recently at the Indian Agri[illegible] Research Institute:

Guar gum content in different varieties

S.No.	Name of the variety	Gum content %	Colour of the gum	Sticking power of the gum.
1.	I.C.9007	22.13	Greyish white	+ +
2.	I.C.9230	33.34	White	+ +
3.	I.C.9004	0.955	White	+ +
4.	I.C.9026	0.865	Brown	+ +
5.	I.C.8926	11.13	White	+ +
6.	I.C.9233	6.07	Grey white	+ +
7.	Sada Bahar	3.17	Brown	+ +

Steps will have to be taken for the rapid multiplication of the variety with high gum content and for making the Guar Gum Industry variety-conscious. If we can rapidly exploit

Contd.....p/7.

this possibility, a very good export market can be developed since the use of guar gum in the manufacture of detonators and in the textile, paper, pharmaceutical and food industry has been registering a rapid rise. There is no synthetic gum having the same wide use and unique properties of guar gum.

e) Breeding chilli varieties with a high Capsaicine content:

Capsaicine is used both in the food and pharmaceutic industires. The varieties which are now being used for capsaicin extraction have coloured fruits. Importers of this product would like to have pure capsaicine free of contamination with pigments. Hence, it is necessary to develop varieties with colourless fruit and a high capsaicine content. The fruit pigment can also be exported or used locally as a colouring matter for food. The work now underway at the Indian Agricultural Research Institute suggests that within the next year there will be possibilities for improving the export of capsaicine through the use of a new variety.

f) Spices:

The present area and production of the major spices crops and cashewnuts are given below:

Crop	Area (in acres).	Production (in tons)
Pepper	2,53,818	27,897
Cardamom	1,35,764	3,158
Ginger	53,850	22,435
Turmeric	95,850	85,806
Chillies	14,50,000	3,88,000
Cashewnuts	2,80,531	1,15,377

As will be seen from this data, the yields are very poor. It is possible to step up yields considerably through better manurial practices and disease control methods. In addition, the following items of work need urgent attention for stepping up our exports of cardamom and pepper, which are showing a tendency to decline. In cardamom, methods of retaining the green colour of capsules beyond the normal period of 2-3 months should be stepped

Contd....p/8.

tandardised, while in pepper an economic process for making white pepper should be immediately evolved.

With reference to the other spices, the annual export of coriander and cumin have declined from about 3500 tons in 1946 to 1950 to about 1200 tons each in 1965. Also, our 1965 trade in vetiver oil was only 3000 Kg. against the world consumption of about 200,000 Kg. Similarly our present contribution of fennel (600 tons) and sowa oil (150 Kg) is only a small portion of the total world consumption. The finances for the above mentioned scientific guidance is extremely high in the case of spices and essential oils and was mainly provided by the highly industrialised nations and the technical know how involved has been kept secret wherever possible. In view of the very high initial cost of development little work of any practi - value on improving quality standards of spices and essential oils could so far been done in India.

The quality of spices depend primarily on the quality and quantity of essential oils they contain, quality again depending on the chemical composition which in the case of case of essential oils means predominant groups of similar compounds (frequently this comes down to a single component as for example thymol in the case of ajowan) which differ from spice to spice. The determination of chemical composition of essential oils is unusually complex, tedious and expensive by available conventional methods; further any given set of analytical procedures will generally serve only for a single spice or closely related group at most and not for any large number of oils.

Investigations at the Indian Agricultural Research Institute have lead to the development of a number of new techniques which can be satisfactorily used for quality assay with milligram quantities of most of the oils concerned in our export trade.

Contd....p/9.

These methods have effected considerable economies in the time and expenditure involved in the quality assay of spices and essential oils and for thefirst time make it possible to do this work on a really large scale in India with comparatively low expenditure. This has already been done for ajowan and from the large number of morphologically indistinguishable strains three or four having 3.3.-3.5% thymol content have been picked out. The quality of ajowan depends almost entirely on its thymol content and the ajowan seed is evaluated and priced entirely on this basis. Extended cultivation of the 3.5% thymol content ajowan can soon produce a large increase in the foreign exchange earnings from ajowan alone since most of the usual strains contain only 2.2-2.6% thymol.

Extension of this selection work based on quality assay of essential oil can be made to the other important spices which figure in our export trade e.g., cumin, fennel, dill, anise vetiver, cinnamon, cardamom, This can also help in the development of the clove plantations coming up leading us to export high quality cloves in the not too distant future (at present we import large quantities of cloves). The work can be usefully extended to other essential oil producing plant material as well which can be successfully grown in India.

g) Pesticides of plant origin:

There has of late been a growing awareness of the need to exploit more fully plantpesticides rather than synthetics An extract from the report of the Indian Trade Delegation that visited Thailand, Japan, Hongkong, Malayasia, Australia and Ceylon in March, 1965 is given below:

"In discussion with the Sanyo Trading Company (Japan) Agricultural Chemicals Sections, details were given of the value of imports of agricultural chemicals by

Contd.....p/10.

Japanese companies, which show the various sources of supply and also demonstrate that Sanyo are now the leading importing company in Japan, having 21% of the value of total imports in 1964. Details are given in Table at the end of the chapter.

Some of the important materials which are required to be imported by Sanyo are:

Nicotine extract	98%	8-10 tons
Nicotine sulphate	40%	40-50 tons

Nicotine formulations have a special place in pest control in young citrus where other insecticides are phyto-toxic. The area of citrus is rapidly expanding and the presentrequirement of 400 tons of Nicotine Sulphate a year, may well increase. Domestic production is at present limited to about 50 tons, with a maximum capacity of 100 tons.

Prices of Nicotine have risen steeply since 1963 as is shown by the following details:

Nicotine Alkaloid:

January, 1963	U.S.	$ 3.70/kg	CIF
June, 1964	U.S.	$ 8.45/kg	CIF
February, 1965	U.S.	$ 8.35/kg	CIF

Nicotine Sulphate;

May, 1964	U.S.	$ 4.10/kg	CIF
January, 1965	U.S.	$ 3.85/kg	CIF
March, 1965	U.S.	$ 3.65/kg	CIF

It will be seen that there is a slight falling off in price this year, but it has a long way to go to reach the 1963 level of normalcy. The selling price of Nicotine Sulphate formulations has more than doubled in the last years".

This is the field which deserves to be developed immediately.

Contd...p/11.

3. Import substitutions:

i) Coconut:

The possibilities of reducing the import of copra woul be very great if the Tall x Dwarf hybrids are multiplied and distributed on a large scale. The work on control of the wil disease of coconut needs to be intensified.

ii) Long staple cotton:

Some very good varieties are currently under developme in the country and these should be multiplied and grown on as large scale as possible.in the immediate future, so that the import of long and extra long staple cotton can be stopped.

iii) Internal production of plants containing important chemicals:

Colchicine extracted from the autumn crocous (Colchicu autumnale) is now being imported and there has been no synthet analogue for it. It should be possible to grow this plant in some of our hilly areas and manufacture colchicine both for our internal use as well as for export. Items of this kind should be identified and actions taken to realise the possibilities.

iv) Production of seeds of temperate vegetables:

The programme of multiplying the seeds of the temperat vegetable varieties in the hills should be expanded and all import stopped.

4. Conclusions:

The above are just a few examples of the vast scope which exists for paying concentrated attention to both export promotion and import substitution through agricultural resear What is needed is an awareness of the possibilities of attack these problems scientifically and solving them within a short

Contd....p/12.

period of time. For meeting any expenditure connnected with the implementation of these projects, suitable allocations could probably be made from the block grant for agricultural research which the Scientists' Panel had recommended during the Fourth Plan.

..*

MSS:nji

Table 1

Performance of Indian Sorghum hybrid in Brazil

Variety or Hybrid	Yield of dry seeds kg/Ha.
MS x IS 3691 (C.S.H.$_2$)	3,669
MS 630	3,353
RS 608	3,224
DEKALB 81-5 x 11	3,134
NK 221	3,122
RS 610	3,103
KS 652	2,986
NK 125	2,943
MS x IS 532	2,743
DEKALB C 44B	2,719
LINDSEY 788	2,551
SD 451	2,526
DEKALB E 56 A	2,479
SD 503	2,361
TEXAS 660	2,200
SD 441	1,938
SH 10	1,350
DEKALB SX-11	1,295
SD 102	1,009
IS 1056	898

Table 2

Yield performance of some maize materials from India in South-East Asia

PEDIGREE	INDONESIA				THAILAND	
	BOGOR		WONOSOHO		PRABUDDABAT	
	Kg/ha	% of local	Kg/ha	% of local	Kg/ha	% of local
ETO AMARILLO X DORADO DE TEQUISATE	5592	134	4231	117	3018	122
ETO X FERGUSON YELLOW DENT	6987	168	2010	56	-	-
SYNTHETIC 2	6510	157	3050	85	-	-
COMPOSITE B 1	5978	144	2953	82	3143	124
COMPOSITE A 1	-	-	-	-	3143	124
GANGA 101	5557	134	3704	103	-	-
GANGA 2	6365	153	3514	97	-	-
DECCAN	6264	151	4080	113	-	-
LOCAL	4156	100	3605	100	2500	100

MSS:nji

..*