

Castor Production in the Madras State

by K. THANDEVARAYAN,
Assistant in Oil Seeds,
Agricultural Research
Station, Tindivanam

Introduction: Castor bean has been an important item of commerce since olden times. For many centuries the oil has been used in medicine, in printing, dyeing and machine lubrication. Chemists have found new uses for castor oil and its derivatives. The products are in extensive use for the manufacture of paints, plastics, rayon, textiles, nylon, special lubricants, transparent soap manufacture and many other special items. Great strides have been made in this direction in other countries, but India is only making a beginning in this respect.

Of late, on account of its varied industrial uses, the importance of castor beans in international markets has been high. After World War II, the export of castor beans from India has dwindled, due to increased internal consumption. This has been made possible by the springing up of industrial concerns utilising castor - oil on a large scale.

The area and production statistics in India could be precisely known only since 1920-21 and even then the figures for the different years are not strictly comparable. They were of doubtful accuracy. However taking the face value of the figures, as compared with an area of nearly 1.8 million acres under castor in 1921-22, the crop covered only about 1.4 million to 1.6 million acres during the period 1922-23 to 1928-29. This declined later to less than one million acres by 1941-42. The declining tendency of the crop in the twenties, although the exports were generally on an increase, may be largely attributed to a fall in the demand for castor - oil in India, largely as a result of increasing competition of mineral lubricant oils.

As regards export trade, India has Brazil as a serious competitor in the World market. The conditions in Brazil are very favourable for castor bean production and that country is now the biggest producer of this oilseed in the World. Therefore, India can expect to export castor seed only if she can produce larger quantities at cheaper cost. However, one factor

favourable to India is that it has a well-developed castor seed crushing industry compared to Brazil and thus has scope for developing its export trade in this direction. At present, the scope for increasing the area to increase production is highly limited. Hence every endeavour is to be made to increase per acre production. This is feasible by adopting improved methods of cultivation, judicious manuring and sowing improved strains.

Much headway has been made in other countries in increasing the production of castor beans by mechanised farming in all stages of crop growth. However, in India the use of machinery in castor cultivation appears to be not feasible at present and the new frontiers open are the use of better seeds and adopting improved agronomical and manurial methods for increased production. The per acre production of beans in this State is as low as 226 lb. compared to 600 lb. in Uttar Pradesh.

Extension Work: In these days the problem of a breeder will be to impress upon the farmers, that his improved seed will really do well in the farmer's lands at little expense and trouble. So far a farmer has been content with selecting good seeds from selected plants and raising them after proper cultivation and manuring. Little does he know about the cross fertilisation of the seeds and their subsequent degeneration. Here research can do a lot and in increasing castor bean production in this State, the part played by hybridisation is going to be of primary importance.

Present Breeding Technique in Castor Crop Improvement in Madras State: (A) *Pure Line Selection:* The procedure adopted in this method is as follows:

First Year: Observation trials. New collections are sown with the already improved strain as check and studied. Plants showing desirable economic characters like good branching, long fruit clusters, compact setting of capsules, non-dehiscence, resistance to pests and diseases (by visual observation only) are selected. The selected plants are selfed by using close-meshed cloth bags of convenient size and selfed seeds gathered.

Second Year: Purity Study. The selfed seeds of the selected plants are sown in single rows and plants studied for purity of their morphological characters and incidentally their yielding ability. The unstable lines are rejected and promising pure lines alone taken for further study.

Third Year: Replicated row tests. The promising ones are raised in single rows under replicated conditions, adopting randomised block layout. The selections are compared with standard strains in respect of yield, duration etc. The yield data are scrutinised statistically.

Fourth year: Preliminary yield trials. Those that show promise in the replicated row tests are put under preliminary yield trials. The selections are sown in three-row plots (effective one row only) under replication for comparison with the standard strain. The yield data are analysed here also statistically.

Fifth year to Seventh year: Comparative yield trials: Selections that have done well in the preliminary yield trials are advanced to comparative yield test for three years. The selections are sown along with the strains in five-row plots under replicated conditions in which three rows only are utilised. The yield figures are subjected to statistical scrutiny every year and only those that are consistently recording higher yields are given out for trials in the districts. Qualitative studies are carried out from the preliminary stage on the produce of all the selections under trial with a view to maintaining a high standard of quality.

(B) **Hybridisation:** Producing improved strains of castor by breeding, takes a great deal of patient hard labour for about eight years, involving inbreeding and cross breeding. Complicated and tedious as this is, it is simple compared to the task of discovering that it could be done and how to do it. In self-fertilised crops an experimenter can depend on nearly all the plants to be like the parents but that is not so in a cross-fertilised crop like castor. The selected parents are purified by careful selfing for two generations. The inbred lines with the desired characters are raised alongside and hybridisation attempted. Selection of lines for new combinations are done in the progenies of F_2 and F_3 generations. They are then brought to purity studies and further work is similar to that indicated under item (4) above.

The evolution of better strains by breeding methods and the exploitation of hybrid vigour in castor may play an important part in this State in increasing castor bean production. The commercial production of hybrid castor beans has not been attempted so far in India, although it is in vogue in S. America. Nowadays

in most of the advanced countries the exploitation of hybrid vigour in many cross-fertilised crops has been successfully done and this may be considered as a new trend in advanced agricultural research.

Review of work done in other countries: At the Illinois Agricultural Experiment Station, the use of natural crossing plot in making castor been hybrid has been tried as far back as 1944 and 1945. The technique was similar to that used for making single cross of corn, except that the pollen and seed parents were planted in alternative rows.

Yet another method evolved in the United States of America for commercial production was by three-way crosses. Here the pronounced pistillate character in a female line when sib-pollinated was found to segregate in the ratio of 1:1 for plants which have only pistillate flowers and plants which have the normal monoecious racemes. This line was used as a female parent in producing commercial F_1 single-cross hybrid seed. These pistillate F_1 hybrids suggested the investigation of three-way cross by scientists in America, for making commercial hybrid seed. The procedure involved for production of three-way hybrid castor beans is:—

(1) Cross the selected female line to a selected male parent which would produce pistillate F_1 progenies. This female line was initially obtained by sib-pollination and types with well-pronounced pistillate character selected by roguing the off-types. Generally, upto eight rows of the female line can be satisfactorily pollinated when interplanted between two rows of the desired male parent.

(2) Cross the pistillate F_1 progenies obtained from the previous cross to a selected pollen-producing line with good combining ability. As mentioned above, planting upto eight rows of pistillate F_1 plants to two rows of the pollen line will be adequate. Since all the F_1 plants will be pistillate it would not be necessary to rogue normal monoecious plants as was the case in the initial cross.

Methods Suggested for Production of Hybrid Castor Seeds in Madras State: At the Agricultural Research Station, Tindivanam, inbred lines with the desired characters are available for the production of single cross as well as three-way cross hybrid seeds.

TMV I strain of castor is well suited for use as the female line in the single cross hybrid as the pistillate nature of the raceme

is well pronounced. This can be used as a seed parent. From the 140 inbred lines grown and maintained on the Agricultural Research Station, Tindivanam, suitable pollen parents can be easily selected. The pollen parent can be raised in each outside row as well as in alternate rows to that of seed parent lines. The seed parent may be emasculated before pollen is shed by hand. The emasculatation process may last several weeks. The seeds in the female parents which are naturally hybridised may be harvested when mature and plants pulled down. To cut down the expenditure in emasculatation the production of hybrid seeds may be limited to only the main heads, though this might result in reduced quantity of hybrid seeds.

Three-way Cross Hybrid Seeds: As already stated, the strain TMV I, is best suited as a female parent in view of the well-pronounced pistillate nature. It may be sib-pollinated and the resulting seeds sown. In the progeny consisting of the normal monoecious plants and completely pistillate plants, the former may be rogued. The completely pistillate line will be crossed to a selected male parent. The resulting progeny will have all pistillate flowers. The hybrid seeds obtained by this single cross may be crossed to another selected pollen parent. The hybrid seeds will be tested along with the strains in yield trials and their superiority over the strains under distribution will be established. The production of three-way cross hybrid seeds at this station on a large scale by the above procedure will go a long way in increasing the production of castor beans in this State.

Summary: Castor is not, of course, a major oilseed crop of this State, but it is grown to an appreciable extent in the districts of Salem, Coimbatore, Trichinopoly and North Arcot. Of late, the oil is put to varied uses and this is especially so in America. Important uses of the derivatives are for lubrication of jet airplane engines, all-purpose greases, hydraulic fluids, plastics and many others. The cake is also in great demand. The crop has a bright future. In the matter of world production Brazil is the largest producer, followed closely by India. To increase the overall production of beans in India and in Madras, the only way open is to increase the per acre yield, as no increase of acreage under castor is possible at present. The acre yield in Madras State is low compared to other centres and States.

Great strides have been made in foreign countries, in the exploitation of hybrid vigour and production of hybrid castor seeds by improved breeding techniques. The methods adopted by them are worthy of emulation in this State. The procedure to be adopted, for increasing the production of beans in the Madras State, has been indicated in the article. It is hoped that the production of hybrid castor seeds will help increase the per acre production in the Madras State in the near future.

Acknowledgement: The author's thanks are due to Sri N. Srinivasalu, Assistant, Agricultural Research Station, Tindivanam, for his suggestions in writing up this article.

REFERENCES

- | | | |
|--|------|--|
| 1. Weibel R. C. and Woodworth C.M. | 1946 | J. Am. Soc. of Agronomy,
Vol. 38, p. 563—565. |
| 2. Report on the marketing of castor seeds
In India | 1947 | Manager of Publications,
Delhi. |
| 3. Castor bean production, Farmers'
Bulletin No. 2041 | 1952 | U, S. Department of
Agriculture. |