POTENTIALS FOR NEW CROPS TO MEET
NEW EXISTING DEMANDS

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Approximately two years ago, the Congress authorized the appointment of a commission \(^1\) to study the possibilities for greater industrial utilization of agricultural products. Major objectives of this study were to determine if possible expansion of industrial uses might serve to utilize surplus products now in storage and to find new agricultural crops having unique industrial uses that could be grown as a replacement for those crops now produced in surplus. This commission under the chairmanship of S. Leroy Welsh with Mr. Wheeler McMillan as Executive Director established "task groups", each to deal with a specific aspect of the entire problem.

After study of the problem, among other recommendations, this commission recommended that appropriate steps should be taken to enact legislation by the congress to provide appropriations for research and for such other programs related to industrial utilization as was deemed necessary to carry out its recommendations. A bill was introduced in 1958 requesting appropriations to implement these recommendations.

Emphasis on programs to find new uses for agricultural products is not new. Surplus of crops in the 1930's became an important factor in the decision to establish four regional research laboratories in the U. S. Department of Agriculture; the one for this region located at Peoria, Illinois. According to the original mandate, nearly all research at these laboratories was to be directed toward finding new, improved or expanded uses for existing commodities. This is in sharp contrast to the present proposed program (for crops) to find new crops to replace those in surplus.

That opportunities exist for the establishment of new crops can hardly be denied. About 50 years ago, soybeans were grown on only a very limited scale (less than 50,000 acres); today this crop is grown on nearly 25 million acres. Ten years ago the acreage of safflower was essentially none, while now the acreage is over 100,000. Among the 250,000 species of higher plants, less than 100 have an annual value of $1,000,000 each in the U.S.A.

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\(^1\) Public Law 540 -- 84th Congress, Sec. 209.
Very few crops can be called "new crops" in the most strict sense. Nearly all crops now grown were important in some parts of the world long before they were introduced into American agriculture.

For purposes of this seminar, a "new crop" will be defined as one not currently in domestic use, or if so, on such a limited scale that its importance has not yet enabled it to find its potential place in culture and one whose use fills a new need. In an economy of surplus feed crops a new crop thus cannot be one which only serves as a substitute for uses of existing crops. For example, grain sorghum, although relatively new in many parts of the U.S.A., is in reality only a substitution crop for corn and other feed grains. Hence, it serves no real function in a new crops program designed to establish new uses for agricultural products. In contrast, if a new use can be found for an existing crop this expanded use may make possible the absorption of a surplus. In this discussion, major emphasis will be given to finding new crops whose potential use does not become a substitute for an existing crop.

The logical starting point in a new crops program is to determine needs based on the end-point uses of plant products and from these needs to determine which new species might best fulfill them. This process has been described as "an educated fishing expedition" by Wolff and Jones. The task force on New and Special Crops under the President's Commission has outlined the major new and expanded needs for crop products in the following categories:

1. **Pulp and Cordage Fibers**
   a. Paper and paper products - 30 million tons, much of which is imported.
   b. Dissolving pulps (cellophane and cellulose derivatives - 800,000 tons).
   c. Hard fibers - 200,000 tons imported.
   d. Soft fibers - 850,000 tons imported.

2. **Gum-like products**
   Carbohydrate gums and mucilages used in textile printing, paper coating, etc. - 40 million pounds imported.

3. **Proteins for industrial and feed uses.**
   Industrial use of protein now at 100 million pounds annually. More economical plant source needed.

2/ Chemurgic Digest, September, 1958.
4. Industrial Vegetable oils
   Present use of synthetic chemicals at 3 billion pounds. New oils needed with specific properties.

5. Waxes
   Present import 30 million pounds.

6. Pharmaceuticals
   Present and potential acreage for obtaining drugs from plants is small.

7. Tanning agents
   Present import about 64,000 tons annually.

8. Insecticides
   About 100 million pounds used annually of which 7.2 million pounds from plant sources.

9. Antioxidants
   Used in petroleum products, paints, etc. Present use 88 million pounds. Many plant products have antioxygenic properties.

10. Films and Fibers
    In 1954 over 350 million pounds of cellulose film produced. Markets are expanding.

11. Soil conditioners

12. New Foods

13. Seeds
    Estimate needs of 450,000 acres to produce crop seed now imported.

On the basis of the above information, the New Crops Research Branch in the Crops Research Division and comparable units in the Utilization Research and Development Divisions have jointly undertaken a research program to procure promising new crops and to screen them for their unique chemical components that would economically fill these needs. Although this program has been in operation for only a very short period of time, a few promising leads have been found in the following specific categories:
1. Oilseeds
   a. Species high in erucic acid (Brassica family)
      Brassica campestris, crambe abyssinica, Eruc a sativa, etc.
   b. Species high in petrosilinic acid. Daucus carota,
      Foeniculum vulgare, Apium graveolens, etc.
   c. Species high in diene-containing oils. Rudbeckia
      bicolor, Helianthus maxmiliana, Helianthus annus, etc.
   d. Species high in triene-containing oils. Monarda
      fistulosa, Margorana hortensis, Euphorbia marginata, etc.

2. Pulp crops
   Crotolaria juncea, Sesbania sp., Sorghum almum

3. Non-starch carbohydrate gums
   Guar

The above is only a partial list of plant species that have potential new
industrial uses. In certain cases, especially in the oil seeds, the residue
also is high in protein.

From prior exploratory work on new crops, another group of species appear
to have industrial usefulness. Certain of these species are now grown to a
limited extent, but the industrial development of their products has not
progressed to a large enough scale to provide important replacements for
existing crops. These crops include:

   Potential use in 3 years; 120,000 acres, in 13 years
   500,000 acres, in 23 years, 1,000,000 acres. At
   present only 5,000 acres grown in southwest.

2. Canaigre - a source of tannin.
   Present acreage, essentially none; potential 100,000
   acres. A root crop, harvested in second year from seed.
   Largely adapted to southwest.

   Present acreage small; potential 1,000,000 acres. Largely
   adapted to southeastern states.

4. Jojoba - a source for wax.
   Present acreage none; potential 150,000 acres. Largely
   adapted to southwest. A shrub growing to maturity in 8-9
   years. Liquid wax obtained from nuts.
5. **Kenaf - a source for soft fiber.**
   Present acreage almost none; potential 200,000 acres.
   Largely adapted to cotton belt and southern part of corn belt. An annual crop.

6. **Sansevieria - a source for hard fiber.**
   Present acreage very small; potential 100,000 acres.
   Largely adapted to southeast. Crop established from cuttings and harvested 3-4 years later.

There are many problems associated with the development of a new crop in American agriculture. First, from the viewpoint of production, it must be adapted to mechanization. With farm labor supplies dwindling, any new crop that requires excessive hand labor in planting and harvesting can hardly be expected to find acceptance. Second, production practices must be determined to attain optimum procedures for growing the crop. Present crop plants widely grown have passed through a long transition period (and still subject to change) in this respect. Third, development of superior strains by breeding will surely be necessary to improve agronomic, chemical, disease and insect resistance. American farmers have come to expect their crops to be improved in these respects. Fourth, industry utilizing the product derived from the crop must be assured of a stable outlet for the product to justify investment in plant facilities. Fifth, the competitive position of the industrial product must be favorable either to a synthetic source or to imports from abroad where the product might be produced at a lower cost. The implications of producing at home, rather than importing, to the balance in trade for those crops which we export to other countries may in the long run be disadvantageous to our own economy.

The discussion thus far has been concerned largely with "new crops" for industrial uses. Perhaps equally important is an analysis of the potentials from modification of existing crops to meet new industrial demands. The advantages of this approach are obvious, since the know-how of producing the crop has been established. Two examples may be cited to illustrate this point.

1. **Development of waxy endosperm in maize.** This type of starch provided a replacement for a similar type previously obtained from the cassava root imported from the Dutch East Indies. This type of starch is used in food products (tapioca and instant puddings) and for glue and other adhesives. Approximately 100,000 acres of waxy corn are grown to provide this type of starch.
2. Development of high anylose starch in corn. Current research suggests the possibility of adding these genetic factors for high amylose to existing lines of corn. The straight-chain starch molecule of this type offers promise for use in films and fibers.

**General Summary:** The development of new crops to replace those now in surplus should not be considered as a short-time research and development program. Establishment of a new crop (for crops) requires a coordinated program among several agencies to firmly establish the demand for its product, the competitive relationships of the product with alternative sources of supply and the potentials for its economic production as a crop under present day mechanized agriculture.