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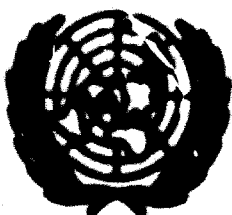
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United Nations Industrial Development Organization

Expert Working Group Meeting  
on the Production of Fungic  
from Agricultural Wastes

Vienna, Austria, 14 - 18 December 1970

**FINANCING AND TECHNICAL ASPECTS OF MANUFACTURED CLOTHES SEAMER  
FOR THE PRODUCTION OF PARTICLE BOARD 1/**

by  
Ebrahim Mahdavi  
Gorgan S.A.  
Gorgan, Iran

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**SUMMARY**

**ECONOMIC AND TECHNICAL ASPECTS OF HARVESTING COTTON SEEDS  
FOR THE PRODUCTION OF PARTICLE BOARD <sup>1/</sup>**

by  
**Ebrahim Khatibi**  
Gorgan S.A.  
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The manufacturing of panels in Iran up to a few years ago was limited to several match factories in North-Western part of the country and another along the shores of the Caspian Sea. The machinery for the make up of panels was designed and built locally and it was crude in form and inefficient in operation. The raw materials used for making panels were the wastes of match factories. The panel output of these plants was about fifty tons per day and their qualities inferior to those manufactured abroad. The panel consumption within the country was not much to even absorb such a low production rate.

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Corgan is a city in the South-Eastern part of the Caspian Sea. The terrain surrounding this city is fertile and about 300,000 acres of this fertile land is utilized to the cultivation of cotton. After the cotton seeds are picked up, the stalks were left alone and there was not much use for this agricultural wastes.

It dawned on the writer that there must be ways and means by which something like particle board could be obtained by putting cotton stalks through some mechanical and chemical processes.

On a trip around the world the matter was taken up with some manufacturers in Germany. They welcomed the idea and asked for the shipment of a representative sample of cotton stalks.

The samples were later sent to them for a test the results of which was promising. On the basis of these findings and further studies on capital investment, production costs, selling price and local consumption of pulps, a plant with an output capacity of fifteen tons per day was ordered from Germany.

Presently, the plant is running at full capacity and preparation has been made to raise its production by expansion and addition of equipment to twenty-five tons per day.



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**MINING AND TECHNICAL AGENCIES OF NAZAFESHAN OFFICE BRANCH  
FOR THE PRODUCTION OF PARTICLES ROAD**

by  
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Tehran S.A.  
Gorgan, Iran

Corrections

**Page 5**

Second line from the bottom:  
CHANGE "031,183" to read "05,000".

**Page 6, line 1100**

CHANGE "0.768" (19 mm) to read "4 mm".  
CHANGE "1.57" (38 mm) to read "38 mm".

**Page 6, line 9**

CHANGE "1230,400" to read "123,000".

(1)

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## INTRODUCTION

In a developing country such as Iran which is rich in natural resources and has a potential for industrialization, a man with some ingenuity and initiative can help to create jobs for the people, fulfill the demands of consumers for more manufactured goods, and simultaneously by helping to raise the gross national product can be of much value in raising the living standard of the people in his neighbourhood.

Thinking along these lines and seeing that each year thousands of tons of cotton stalks are left in the fields to decay and to serve as a substitute for organic matters, or to a lesser extent are used for cooking and heating purposes, the writer decided to import this material and put up a plant by means of which this agricultural waste can be converted into panels. It took some planning and much perseverance to import and put the plant in order. The outcome of this project has been as anticipated and the objectives for setting up the plant have all been achieved.

### 1. LOCALITY OF PLANT AND ITS SUPPORTING FACILITIES

The plant is located on a 5,000 acre farm six kilometers North-East of Gorgan. The distance of the plant from the paved road is seven kilometers. The access road is paved with gravel suitable for the passage of heavy trucks in all seasons.

The area on which the plant and its supporting facilities are set up is 4680 square meters. Of this area 4,160 square meters have been allocated to the main plant, cutting and grinding rooms and tool house. The other 520 square meters have been covered by the boiler room and generator house.

The staff and workers' living quarters are nearby. There are ten separate houses, each having two bedrooms, a living room, service and kitchen for married couples and seventeen single rooms for bachelors.

### Capital Investment

The money invested for the purchase, insurance and shipment of plant from the source of origin to the location, plus the total costs of construction and incidentals was US \$ 1,140,000. Of this, sixty per cent was paid in advance by shareholders and the other forty per cent was provided by an industrial credit bank on a loan basis.

## MANPOWER

The plant is supervised by a foreman who is fully authorized and responsible for keeping it running in accordance with the norm suggested by the manufacturer. There are one mechanic and one electrician who work in daylight and another mechanic who works on a night shift. The routine work is performed by a labour force of forty-eight men, sixteen of whom work in each shift.

## II. DESCRIPTION OF RAW MATERIALS

The raw materials which constitute the feed for the plant are mainly cotton stalks, and wood from poplar, alder, and hornbeam trees.

### Cotton stalks

In the farming area of Gorna about 100,000 acres of land are utilized for the cultivation of cotton. The number of cotton bushes on each acre is between 8,000 and 12,000 and the average weight of each green bush is about 100 grams. On the basis of these figures, the yield of cotton stalks per acre should be between two and a half and three tons. However, from what we have experienced so far, the yield of cotton stalks per acre is equivalent to that of seed cotton and is about one and a half tons.

Assuming that all the acreages of cotton stalks are harvested properly, the available crop of this waste would be in the order of 450,000 tons annually. This quantity of raw material could sufficiently feed thirty plants similar to the one at present in operation.

### Poplar

These trees are plentiful all along the coasts of the Caspian Sea. They are being chopped and transported to the factory from distant places ranging from ten to 500 kilometers away from the plant.

About two years ago 150 acres of land on the farm where the factory is was set aside especially for growing poplars. Within a year or two the first harvest will be available. The yield of each acre of poplar is anticipated to be in the order of thirty to forty tons. After the initial yield, these acreages of poplars will be harvested every three years and the yield is likely to be the same if not more.

The other farmers are following this example and it is expected that for the next few years about 12,000 acres of land in the vicinity of the plant will be planted with poplar.



It should be noted, however, that alder and hornbeams which are at present supplied to the factory, are wild trees that have been growing for thousands of years in the forests of North Central Iran.

### III. HARVESTING METHODS

The harvesting of cotton begins in the middle of September and goes on until the middle of January. As soon as the cotton picking is over, the fields are used as grazing areas for some domesticated animals such as sheep or goats. This may go on for a few weeks during which time most of the cotton leaves have been removed. A month or so after the grazing is over, the farmers begin to plow this same land to raise wheat. Thus, one clearly can see that there is only a short time left for the harvesting of cotton stalks.

Before putting the plant into operation, a survey on the merits of mechanized harvesting of cotton stalks was undertaken. A tractor with mowing equipment and a hydraulic press can chop and press cotton stalks over an area of twenty acres of land per day.

In Iran, the capital investment for the purchase of such a machine is estimated to be about USD 20,000. If the equipment depreciates within 1,000 operating days, the depreciation cost, without taking into account the six per cent annual interest on the original investment, would be twenty dollars per day. This, plus the daily operating and upkeep costs, turns out to be forty dollars per day. Accordingly, the costs of harvesting and pressing cotton stalks using mechanized operations would be about one dollar per ton.

A less favorable result can be obtained when using a manual labour force for harvesting cotton stalks. The average labourer's wage in the vicinity of the plant is between one to one and a half dollars a day. Ordinarily, a man can collect about 500 to 700 kilos of stalks daily. The cost of harvesting would therefore be about two dollars per ton. Hence one can see that this is twice the cost of mechanized harvesting with the further disadvantage that the stalks are not pressed. Transport by tractor and trailers will cost about two to three dollars per ton, depending on the distance from the field to plant. The land owner sells the right to harvest the stalks at five dollars per ton. The cotton stalks, delivered at the site of plant cost nine dollars a ton.

The cost of poplar, including its cost of transportation is about twenty dollars per ton.

The transportation of cotton stalks from the fields to the area surrounding the plant and that of poplar which is transported to the plant from distant places does not create any problems. The cotton stalks are hauled to the plant by tractor trailers, many of which are available in the neighbouring farms. Poplar, on the other hand, is transported to the plant by trucks, and since the coastal roads are all paved, the cost of transportation is not high.

#### IV. STORAGE PROBLEMS

During the construction of the plant and its related facilities, the shortage of capital was one of the main handicaps, and as a result the storage area for stockpiling a year's supply of raw materials could not be constructed. At present, the raw materials consumed by the plant are piled on twelve acres of open space. A few years ago the appearance of spray boll worms in the cotton fields created havoc, and the government set forth mandatory regulations for the farmers to spray the cotton fields with insecticides to ensure the eradication of boll worms. Therefore, when piling cotton stalks in the open, the area on which they are piled should be sprayed with insecticides beforehand. This is an unpleasant and costly operation which cannot be eliminated.

When the raw material is piled up in the open space under humid climatic conditions and heavy rainfalls occur, partial deterioration takes place, resulting in low qualities of raw material on the one hand, and a reduction of its weight due to scattering by the wind, etc. Therefore, together with the expansion of the plant, a programme is set out for the construction of a storage area to the extent that it can cover the usual stocks of raw materials.

Mechanized harvesting of cotton stalks, pressing, and baling should also be initiated immediately after the expansion of the plant and the construction of stores.

The cotton stalks are harvested within a month after the cotton is picked. The weather in this period is fair and somewhat windy, and as a result the remaining cotton leaves are swept away and partial drying of cotton stalks takes place. Under these conditions the stalks are ripe for harvesting, pressing, and baling. To a great extent this reduces the problems of transport from the fields to the storage area and also saves a lot of space.

On the other hand, the transportation of the pressed and baled stalks from the storage area to the plant will be handled with much ease and is accomplished by means of fork-lift trucks.

The detrimental effects of weathering and losses due to wind and rainfall on raw materials stacked in enclosed spaces are practically nil. When the plant is fed with dry materials the quality of the panels improve substantially and the bending and twisting of the panels will be minimized.

#### V. PRODUCTION AND MARKETING

In the first year of operation the raw materials utilized by the plant consisted of seventy per cent cotton and thirty per cent poplar and other woods. It should be noted that the weight of the panels obtained by feeding one ton of cotton stalks into the plant is 110 kilograms and that obtained from one ton of poplar is 600 kilograms. Since the price of cotton stalks is about half the price of poplar, it does not make much difference to use one or the other as far as the cost of raw materials is concerned. Nevertheless, the quality of panels obtained through the processing of poplar is superior to that of those obtained from processed cotton stalks.

The colour of the panels obtained utilizing cotton stalks was dark brown, and not very popular on the market. This, together with the limited applications of panels in the furniture, and radio and television industries caused a setback in the sales volume, and we were unable to market our total production. For this reason in the second year of operation, the raw materials consisted of fifty per cent poplar and fifty per cent cotton stalks, which were simultaneously fed into the chopping machine in this ratio. This feed mixture not only lightened the colour of the panels, but also improved their quality and rigidity.

In the third year of operation, due to climatic conditions and rain-falls, there were some delays in the harvesting and stockpiling of cotton stalks, and not more than 3,000 tons could be provided to the plant. Hence, to keep the plant operating throughout the year over 10,000 tons of poplar were purchased and stockpiled.

#### Production data

The plant output for the first year was 951,183 panels. The length of each board is 8'3" (250 cm), its width 4' (122 cm), and its thickness varies

from 0.768" (19 mm) to 1.57" (38 mm). The thickness of the panels are mainly 0.59" (15 mm) and panels with other thicknesses are manufactured when special orders are received.

The number of panels manufactured during the second operating year was 108,480 an increase of twenty-seven per cent over the first year, and the number of panels produced during the first four months of the third year was 42,800. Assuming that the plant output for the remaining eight months will correspond to that of the first four months, the yearly output for the third year would be 1238,400, an increase of 50 per cent over the first year. Data on the properties and production process utilized are given in the table below:

Density	524-600 kg/cu-m
Thickness of panel before sanding	19.7
Volume of glue per minute	2.1 litres
Emulsion	Positive
Chipping temperature without glue	15°C
RPM of the chipping machine	30
RPM of the tray-moving machine	64
Wetness of chipping with glue	23°
Pressing time	11 min.
Press temperature	151°C
Weight of panel before sawing	33 kg
Thickness of panel after sanding	18 mm

#### Marketing

The panels, which are called "Gopan" in Iran were mainly used up to several years ago in limited quantities in the furniture and radio and television industries. Nowadays, the consumers are finding more and more applications for this product. It is being used for partitions, false ceilings and internal doors etc. The demand for panel products is high and for the time being it exceeds production capacity.

The cost of production for a standard panel, 8.25 ft. x 4 ft. x 0.59 in. (250 x 122 x 1.5 cm) including its transport to the market is US \$4.70. It sells for US \$7.84, of which US \$0.94 are paid to the sales agent. Thus the net profit on each panel is US \$2.20.

The net profit of the plant on the first year was US \$187,400; on the second year US \$238,556; and on the third year is estimated to be US \$282,480.

## VI. CONCLUSION

In spite of its limited capacity the existence of a plant in the Gorgan area has helped to bring prosperity to the farmers and people who live in the surrounding area. A number of people who were jobless are now employed and, on the average, are well paid. The cotton stalks which up to several years ago did not have any economic value to the farmers and land owners, are now a good source of income to them. The consumers of the panels no longer need to rely on imports from abroad.

With the establishment of more plants in the Gorgan area, the producers will be in a position to export part of their output to the neighboring countries.

A project is under way to set up several paper mills in the Gorgan area in the coming years. When this project is accomplished, the panel manufacturers will have difficulty in supplying the plants with raw materials other than cotton stalks. Therefore, it has been planned to make three-layer panels in which the external (face) layers are the poplar particles and the middle layers (core) are obtained from cotton stalks or other wood particles.

Advertisement and promotion can be of much value in the marketing of panels. Unfortunately in Iran this has been neglected so far and industries other than furniture and radio and television are not aware of the possible applications of panels in manufacturing their products.

The panel manufacturers in Iran are well aware of their shortcomings and are trying hard to improve the qualities of their product by research and exchange of ideas with their colleagues abroad.

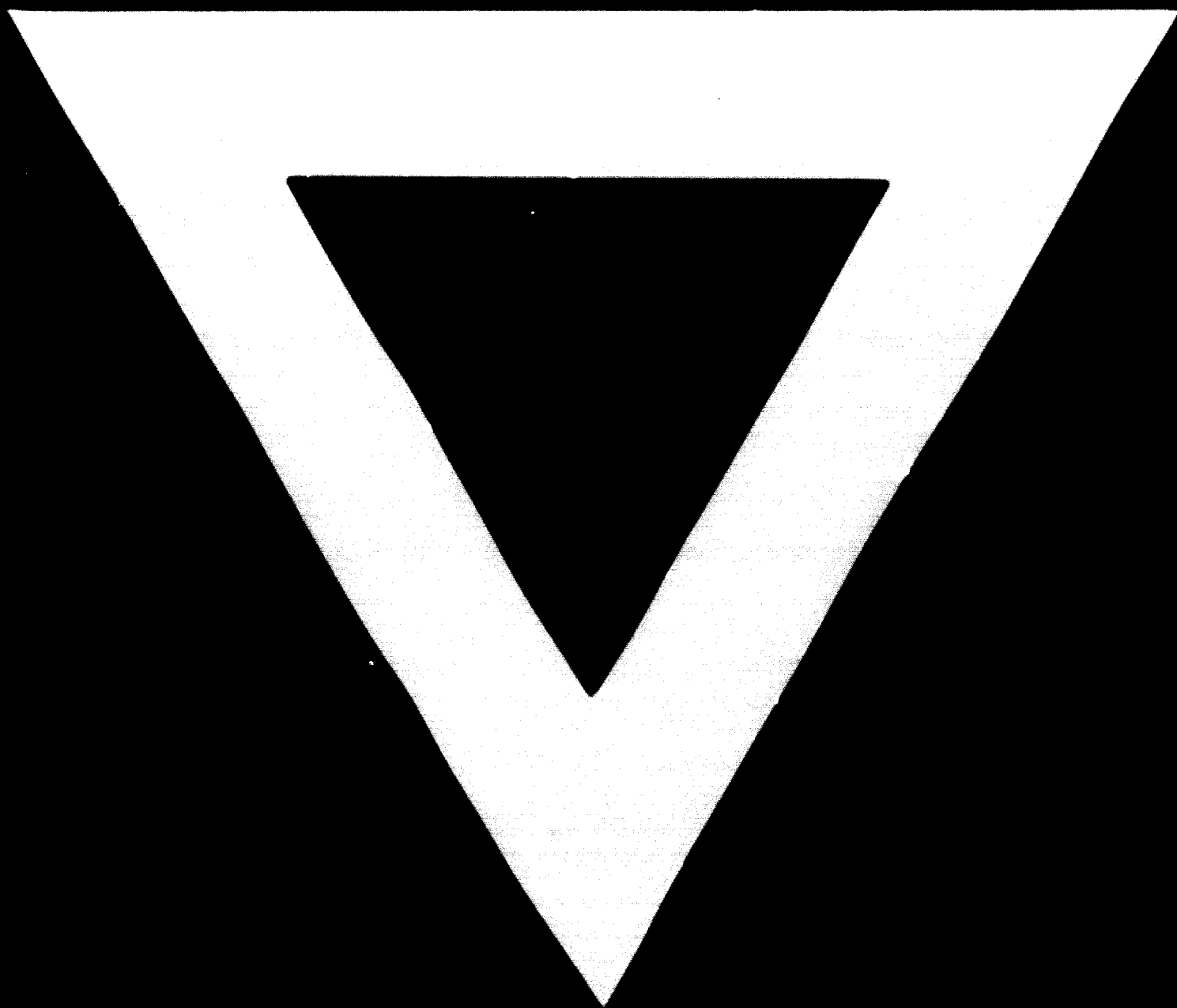
Finally, it should be pointed out that the manufacturers in Iran have experimented to a small extent on the inclusion of wheat or corn stalks as part of the raw materials for the production of panels. The results of these tests have so far not been promising because of the lower compressive strength of panels produced. It may be possible that by the addition of some chemical compounds to the raw material mix the compressive strength can be increased to compare favourably with the wood-based particle boards.

**We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.**



**COTTON STALKS ENTERING CHIPPING MACHINE**





**5 . 4 . 74**