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# A NOTE ON THE EDIBLE OIL MILLING SECTOR, OUTPUT VALUE ADDED AND EMPLOYMENT

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# A NOTE ON THE EDIBLE OIL MILLING SECTOR, OUTPUT, VALUE ADDED AND EMPLOYMENT

by

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The importance of the Edible oil Industry cannot be over-emphasised. The entire urban population and a large proportion of the rural population depends upon it for the supply of its cooking medium.

Indigenous supplies are hopelessly inadequate and large quantities of edible oils have to be imported to meet domestic requirements as is shown in the table below:

Imports of Edible Oils

| Year | '000 tons |
|---|---|
| 1970-71 | 81 |
| 1971-72 | 69 |
| 1972-73 | 70 |
| 1973-74 | 167 |
| 1974-75 | 193.762 |

Source: Agricultural Statistics of Pakistan 1975 Government of Pakistan Planning Unit Agriculture Wing.

Based upon the past trend and assuming that nothing is done to change the deteriorating situation, it has been estimated that from a deficit of 200 thousand tons in 1974-75 this gap will widen to 380 thousand tons by 1979/80 and to 545 thousand tons by 1984/85



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There is thus a need to search for an appropriate technology for edible oil extraction, given our economic technical and agricultural infrastructure, as one of the answer to this worsening problem.

There has been absolutely no work done on edible oil extraction in Pakistan and very little reliable data exists on this very important food manufacturing sector.

This paper makes an attempt at presenting some estimates of the output value added and employment of the edible oil milling sector, and its growth over the year.

There are four techniques available for edible oilseed processing in Pakistan i.e.

(i) Kohlus or Ghanis

(ii) Low pressure Expellers

(iii) High pressure Expellers

(iv) Solvent Extraction.

The first three may be defined as constituting the oil milling sector [see Background].

The main oil seed crops that form the raw material for this sector are cotton seed, rapeseed and Mustard and Sesamum. Though Groundnuts are also grown on a large scale, their oil extraction is not economically feasible because of the large opportunity cost involved [see section on Review of Data and Appendix C].

Review of Data

There is absolutely no reliable data available on the aggregate production, value added or employment in this sector.

The basic data of total agricultural production of the oilseeds used in this paper is taken from the Agricultural Statistics of Pakistan 1975 published by the Planning Unit Agriculture Wing Ministry of Food and Agriculture Government of Pakistan.

The patwaris record the acreage under each crop for revenue records each season. These records are fairly reliable as the acreage in each area has been mapped and surveyed.

The total production of crops is worked out in the following manner.

Production = crop area x normal yield x season factor.

The normal yield is defined as the average of yields in a five year period as determined by official crop cutting experiments. The seasonal factor is subjectively measured by revenue and agricultural officials. It is an index relating current year yield to the historical average for the area.

"The last two variables in the above formula are satistically unreliable. Random surveys have established that true yields are significantly different from official estimates. The results of these surveys indicate that official yields consistently under-yields by 10 -1 5 percent. In a season of poor crop official figures over estimate and in favourable years tend to under estimate production".(10).

The output value added and employment ratios were taken from the Basic Statistics on Small and Household Manufacturing Establishments; food manufacturing industries except Beverage industries (urban areas of West Pakistan) published in 1967.

To check the validity of the statistics 6 expeller and Kohlu units in different parts of Rawalpindi were surveyed by the author and it was found that the statistics were reliable. It was also confirmed that both Kohlus and Expellers bear a constant input: Output and input: employment ratio.

Methodology

This paper is based on the following assumptions:

(1) There has been no technological change in the oil milling sector in both expellers and Kohlus.

(2) There is thus a constant input: output ratio and also constant input: Value added and input: employment ratios.

(3) All the seed that goes into edible oil manufacture is processed by the oil milling sector (see Appendix A).

The basic data is taken from the Agriculture production series for each oil seeds crop. Government figures of 68% of total cotton seed, 95% of total rap seed and 93% of total sesamum produced were used to estimate the amount of seed that goes into oil milling. To arrive at the value of each oil seed crop. weighted average prices of 1966 of each of these three oil seed crops were used. Hence a series of value for each crop from 1947 to 1975, in 1966 prices is obtained.

The values of the three oil seeds for each year (were) summed up to arrive at a total value of raw material that goes into the oil milling sector.

We have statistics on a very representative sample of this sector from a survey conducted by the West Pakistan Small Industries Survey Organization of the WPSIC in 1966 [3]. It covered 478 oil milling units - 312 small industries and 166 household units (category 20910 or the survey). It provides data on value of raw material, value of output value added and employment for both Kohlus (household) and Expellers (Small Scale) and in aggregate for a sample of the oil milling sector (small scale and household). From here ratio of output: raw material, value added: raw material and employment: raw material were obtained.

These ratios were applied to our value of raw material series to arrive at the value of output, value added and employment figures for the entire industry. Since cotton seed can be crushed only by expellers (and not by Kohlus) and makes up about 70% of total value of seed in production, to give more precision to the estimates we evaluate the value of output value added and employment generated by the cotton seed processing under expellers using expeller ratios for the same. To obtain the value of output, value added and employment figures for Rape Seed and Mustard, and Sesamum seed the aggregate ratios (i.e. expeller and Kohlus combined) were used, as these crops are crushed by both expellers and Kohlus. The three ratios (i.e. value of output : value of raw material, value added: value of raw material and employment : value of raw material) for expellers and Kohlus combined and for expellers separately obtained from the sample survey are given below:

a. 1. For Cotton Seed (from expeller only)

Ratio of value output to value of raw material:

$$r_1 = \frac{81903.46}{69041.43} = 1.859$$

2. Ratio of Value-Added to value of raw material:

$$r_2 = \frac{11633.12}{69041.43} = 0.1684$$

3. Ratio of Employment to value of Raw Material:

$$r_3 = \frac{2374}{69041.43} = 0.0340$$

b. For Rape Seed and Sesamum Seed (from expellers and Kohlus Conbined)

1. Ratio of value of output to value of raw material:

$$r_{1a} \quad \frac{83428.40}{69854.65} = 1.1943$$

2. Ratio of value added to value of raw material:

$$r_{2a} \quad \frac{12530.45}{69854.65} = 0.17938$$

3. Ratio of employment to value of raw material:

$$r_{3a} \quad \frac{2602}{69854.65} = 0.03725$$

Hence in general $r_i$ x value of raw material would give us value of output, value added or employment depending upon the value of $r_i$.

Total value of output, value added and employment were obtained by adding the respective figures for cotton seed and rape seed and sesamum seed i.e.

1. $VO_T = VO_C + VO_{R+S}$

2. $VA_T = VA_C + VA_{R+S}$

3. $E_T = E_C + E_{R+S}$

where the symbols VO, VA and E, represent value of output, value added and employment respectively, and the subscripts T is for total, C for cotton seed and R+S for rape seed and sesamum.

Since the series is in constant prices of 1966, we can calculate the growth rates in total value of output as a proxy for the growth in total physical output.

<u>Results</u>

Table 1 shows the total edible oilseed production in the country and the proportion of this that goes into edible oil manufacture. Table 2 shows the value of output, value added and employment generated from cottonseed expelling. Table 3 shows the value of output, value added and employment generated from rapeseed and mustard and sesamum expelling. Table 4 shows the total value of output, value added and employment of the oil milling sector.

The results indicate that the output of this sector grew at a rate of 3.6% over the 28 years from 1947/48 to 1974/75.

If however five year periods are taken the growth rates are:

| | | | |
|---|---|---|---|
| 1959-60 | to | 1964-65 | 2.11% |
| 1964-65 | to | 1969-70 | 5.7% |
| 1969-70 | to | 1974-75 | 2.1% |

The fluctuations in growth rates may be attributed to the fluctuations in the availability of raw material.

In recent years the Government has fixed the price of cotton seed oil at Rs. 200/- md and due to the substitutable nature of edible oils, the prices of the other edible oils cannot vary very much above Rs. 200/- md. This makes it difficult for the oil milling sector to cover costs etc. This squeeze is transmitted to the agriculture sector which supplies the raw material. Due to the unattractive prices of oilseeds, farmers only grow them on marginal lands. Yields are poor, acreage is limited and hence the availability of raw materials is static and inadequate. This is the main reason for the oil milling industry not keeping pace with the growth in domestic demand.

Our estimates of the value of output, value added and employment could be slightly biased in regards to rapeseed and mustard and sesamum processing. These make up about 30% by value of the raw material that goes into oil milling.

There is no method whereby we can evaluate how much of the raw material goes into expellers and how much of it goes into Kohlus. There is a substantial difference in the extraction rates value added and employment in both the techniques.

The expellers have much larger capacities, better extraction rates and more organised storage and handling facilities, they function from a 100 to 150 days and in some cases all year round handling the bulk of the edible oilseeds. Kohlus are a village

TABLE I

('000tons)

| | TOTAL SEED PRODUCTION | | | TOTAL SEED IN MANUFACTURE | | |
|---|---|---|---|---|---|---|
| | COTTONSEED | RAPESEED | SESAMUM | COTTONSEED | RAPESEED | SESAMUM |
| 1947-48 | 387 | 172 | 9 | 263.16 | 116.96 | 8.37 |
| 48-49 | 337 | 185 | 6 | 224.16 | 170.20 | 5.58 |
| 49-50 | 433 | 142 | 6 | 294.44 | 130.64 | 5.58 |
| 50-51 | 492 | 196 | 8 | 334.56 | 180.32 | 7.44 |
| 51-52 | 489 | 197 | 7 | 332.52 | 181.24 | 6.51 |
| 52-53 | 625 | 125 | 6 | 425.00 | 115.00 | 5.58 |
| 53-54 | 499 | 163 | 6 | 339.32 | 149.66 | 5.58 |
| 54-55 | 554 | 216 | 6 | 376.16 | 198.72 | 5.58 |
| 55-56 | 587 | 218 | 6 | 399.16 | 200.56 | 5.58 |
| 56-57 | 599 | 222 | 6 | 407.32 | 204.24 | 5.58 |
| 57-58 | 598 | 229 | 6 | 406.64 | 210.68 | 5.58 |
| 58-59 | 555 | 262 | 6 | 377.40 | 241.04 | 5.58 |
| 59-60 | 574 | 235 | 8 | 390.32 | 216.20 | 7.44 |
| 60-61 | 593 | 211 | 7 | 403.24 | 194.12 | 6.51 |
| 61-62 | 638 | 202 | 11 | 433.84 | 185.84 | 10.23 |
| 62-63 | 721 | 253 | 8 | 490.28 | 232.76 | 7.44 |
| 63-64 | 824 | 208 | 8 | 560.32 | 191.36 | 7.44 |
| 64-65 | 743 | 211 | 9 | 505.24 | 194.12 | 8.37 |
| 65-66 | 816 | 179 | 7 | 554.88 | 164.68 | 6.51 |
| 66-67 | 912 | 200 | 7 | 620.16 | 184.00 | 6.51 |
| 67-68 | 1018 | 270 | 9 | 692.24 | 248.40 | 8.37 |
| 68-69 | 1038 | 225 | 8 | 705.84 | 207.00 | 7.44 |
| 69-70 | 1054 | 251 | 8 | 716.72 | 230.92 | 7.44 |
| 70-71 | 1068 | 156 | 10 | 726.24 | 243.80 | 9.30 |
| 71-72 | 1393 | 296 | 13 | 947.24 | 272.32 | 12.09 |
| 72-73 | 1381 | 282 | 10 | 939.08 | 259.44 | 9.30 |
| 73-74 | 1296 | 288 | 12 | 881.28 | 264.96 | 11.16 |
| 74-75 | 1248 | 244 | 8 | 848.64 | 224.48 | 7.44 |

COLUMNS. 2,3,4
Data Sources: AGRICULTURE STATISTICS
PLANNING UNIT AGRICULTURE WING
MINISTRY OF FOOD & AGRICULTURE GOP.

TABLE 2

| Years | Value Raw material (Cottonseed)* | $V.O_C$ ($r_1 x V.R.M_C$) | $V.A_C$ ($r_2 x V.R.M_C$) | $E_C$ ($r_3 x V.R.M_C$) |
|---|---|---|---|---|
| 47-48 | 182466.986 | 216405.845 | 30654.454 | 6203.878 |
| 48-49 | 155425.771 | 184334.964 | 26111.530 | 5284.476 |
| 49-50 | 204155.785 | 242128.761 | 34298.172 | 6941.297 |
| 50-51 | 231919.352 | 275056.351 | 38962.451 | 7885.258 |
| 51-52 | 230559.209 | 273443.222 | 38733.947 | 7839.013 |
| 52-53 | 294682.169 | 349493.052 | 49506.604 | 10019.194 |
| 53-54 | 235274.233 | 279035.240 | 39526,071 | 7058.22 |
| 54-55 | 260790.078 | 309297.033 | 43182.733 | 7823.70 |
| 55-56 | 276765.351 | 328243.706 | 46496.579 | 8302.96 |
| 56-57 | 282423.380 | 334954.129 | 47447.128 | 8472.70 |
| 57-58 | 281951.877 | 334394.926 | 47367.915 | 8458.56 |
| 58-59 | 261677.766 | 310349.830 | 43961.865 | 7850.33 |
| 59-60 | 27.636.093 | 320874.406 | 45466.864 | 1819.08 |
| 60-61 | 279594.365 | 331598.917 | 46971.853 | 8387.83 |
| 61-62 | 300811.427 | 356762.352 | 50536.320 | 9024.33 |
| 62-63 | 339945.306 | 403175.133 | 57110.811 | 10198.36 |
| 63-64 | 388508.96 | 467701.627 | 65269.505 | 11655.27 |
| 64-65 | 350318.086 | 415477.250 | 58853.438 | 10509.54 |
| 65-66 | 384736.942 | 456298.013 | 64635.806 | 11542.11 |
| 66-67 | 430000.079 | 509980.094 | 72240.013 | 12900.00 |
| 67-68 | 479978.241 | 569254.194 | 80636.344 | 14399.35 |
| 68-69 | 489408.016 | 580437.907 | 82171.605 | 14682.24 |
| 69-70 | 496951.781 | 589384.812 | 83487.899 | 14908.55 |
| 70-71 | 503552.814 | 597213.637 | 84596.873 | 15106.58 |
| 71-72 | 656787.542 | 778950.025 | 110340.307 | 19703.63 |
| 72-73 | 651129.514 | 772239.604 | 109389.758 | 19533.89 |
| 73-74 | 611057.92 | 724708.763 | 102656.891 | 18331.59 |
| 74-75 | 588421.333 | 697867.701 | 98854.784 | 17652.64 |

* Are Price = 693.37/ton
BULLETIN OF MARKETS AND PRICES '66
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TABLE 3

| Years | Value Raw material Rapeseed Mustard | Value Raw material sesamum | z-Value Raw material | $V.O_{r+s}$ $(r_{1a} x V.R.M_{r+S})$ | $V.A_{r+s}$ $(r_{2a} x V.R.M_{r+s})$ | $E_{r+s}$ $(r_{3a} x V.R.M_{r+s})$ |
|---|---|---|---|---|---|---|
| 1947-48 | 126946.021 | 15378.00 | 142324.021 | 169977.578 | 25530.082 | 5301.56 |
| 1948-49 | 184731.739 | 10251.909 | 194983.648 | 232868.970 | 34976.166 | 7263.140 |
| 1949-50 | 141793.990 | 10251.909 | 152045.899 | 181588.411 | 27273.992 | 5663.709 |
| 1950-51 | 195715.675 | 13669.212 | 209384.887 | 250068.370 | 37559.460 | 7799.587 |
| 1951-52 | 106714.214 | 11960.425 | 208674.639 | 249220.121 | 37432.056 | 7773.130 |
| 1952-53 | 124818.816 | 10251.909 | 135070.725 | 161514.966 | 24228.98 | 5031.384 |
| 1953-54 | 162438.00 | 10251.909 | 172689.909 | 206243.558 | 30977.115 | 6432.699 |
| 1954-55 | 215686.740 | 10251.909 | 225938.649 | 269838.528 | 40258.874 | 8416.214 |
| 1955-56 | 217683.819 | 10251.909 | 227935.728 | 272223.640 | 40887.110 | 8490.605 |
| 1956-57 | 221677.977 | 10251.909 | 231929.886 | 276995.862 | 41603.582 | 8639.388 |
| 1957-58 | 228395.797 | 10251.909 | 238647.706 | 285016.9553 | 42808.625 | 8889.628 |
| 1958-59 | 261620.108 | 10251.909 | 271872.017 | 324696.749 | 48768.402 | 10127.232 |
| 1959-60 | 234659.265 | 13669.212 | 248328.477 | 296578.700 | 44545.162 | 9250.2357 |
| 1960-61 | 210694.041 | 11960.425 | 222654.466 | 265916.228 | 39939.758 | 8293.878 |
| 1961-62 | 201707.185 | 18795.303 | 220502.488 | 263346.121 | 39553.736 | 8213.717 |
| 1962-63 | 252633.251 | 13669.212 | 266302.463 | 318045.031 | 47769.335 | 9919.766 |
| 1963-64 | 207698.423 | 13669.212 | 221367.635 | 264379.366 | 39708.926 | 8245.944 |
| 1964-65 | 210694.041 | 15378.00 | 226072.041 | 269997.838 | 40552.802 | 8421.183 |
| 1965-66 | 178740.501 | 11960.425 | 190700.926 | 227754.115 | 34207.932 | 7103.609 |
| 1966-67 | 199710.105 | 11960.425 | 211670.530 | 252798.114 | 37969.459 | 7884.727 |
| 1967-68 | 269608.425 | 15378.00 | 284986.425 | 340359.287 | 51120.864 | 10615.744 |
| 1968-69 | 224673.869 | 13669.212 | 238343.081 | 284633.141 | 42753.981 | 8878.279 |
| 1969-70 | 250636.171 | 13669.212 | 244305.383 | 315669.9189 | 47411.099 | 9845.375 |
| 1970-71 | 373153.827 | 17086.515 | 390240.342 | 466064.040 | 70001.312 | 14536.452 |
| 1971-72 | 295570.728 | 22212.606 | 317783.334 | 379528.635 | 57003.974 | 11837.429 |
| 1972-73 | 281591.173 | 17086.515 | 298677.688 | 356710.738 | 53576.800 | 11125.743 |
| 1973-74 | 287582.410 | 20503.819 | 308086.228 | 367947.382 | 55264.507 | 11476.211 |
| 1974-75 | 243646.122 | 13669.212 | 257315.334 | 307311.703 | 46157.224 | 9584.996 |

\+ Ave price = 1085.38/ton

++ Ave price = 1837.26/ton

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TABLE 4

(Values in '000 Rupees)

| Years | $V.O_{r+s}$ | $V.A_{r+s}$ | $E_{r+s}$ | $V.O_C$ | $V.A_C$ | $E_C$ | $V.O_T$ | $V.A_T$ | $E_T$ |
|---|---|---|---|---|---|---|---|---|---|
| 1947-48 | 169977.578 | 25530.082 | 5301.56 | 216405.845 | 30654.454 | 6203.818 | 386383.423 | 56184.536 | 11505.438 |
| 1948-49 | 232868.970 | 34976.992 | 7263.140 | 184334.964 | 26111.530 | 5284.476 | 417203.934 | 61088.522 | 12547.616 |
| 1949-50 | 181588.411 | 27273.992 | 5663.709 | 242128.761 | 34298.172 | 6941.297 | 423717.172 | 61572.164 | 12604.806 |
| 1950-51 | 250068.370 | 37559.460 | 7799.587 | 275056.351 | 38962.451 | 7885.258 | 525124.721 | 76521.910 | 15684.845 |
| 1951-52 | 249220.121 | 37432.056 | 7773.130 | 273443.22 | 38733.947 | 7839.013 | 522663.341 | 76166.003 | 31296.988 |
| 1952-53 | 161314.966 | 24228.98 | 5031.384 | 349493.052 | 49506.604 | 10019.194 | 510808.018 | 73735.584 | 15050.578 |
| 1953-54 | 206243.558 | 30977.115 | 6432.699 | 279035.240 | 39526.071 | 7058.227 | 485278.798 | 70503.186 | 13490.919 |
| 1954-55 | 269838.528 | 40528.874 | 8416.214 | 309297.033 | 43812.733 | 7823.70 | 579135.561 | 84341.607 | 16239.94[illegible] |
| 1955-56 | 272223.640 | 40887.110 | 8490.605 | 328243.703 | 46496.579 | 8302.96 | 600467.343 | 87383.689 | 16793.565 |
| 1956-57 | 276993.862 | 41603.582 | 8639.388 | 334954.129 | 47447.128 | 8472.70 | 611947.991 | 89050.710 | 17112.083 |
| 1957-58 | 285016.955 | 42808.625 | 8889.627 | 334394.926 | 47367.915 | 8458.56 | 619411.881 | 90176.540 | 17348.187 |
| 1958-59 | 324696.749 | 48768.402 | 10127.232 | 310349.830 | 43961.865 | 7850.33 | 635046.579 | 92730.267 | 17977.5[illegible] |
| 1959-60 | 296578.70 | 44545.162 | 9250.2357 | 320974.406 | 45466.864 | 8119.08 | 617553.106 | 90012.026 | 17369.315 |
| 1960-61 | 265916.228 | 39939.758 | 8293.878 | 331598.917 | 46971.853 | 8387.83 | 597515.145 | 86911.611 | 16681.7[illegible] |
| 1961-62 | 263346.121 | 38553.736 | 8213.717 | 356762.352 | 59536.320 | 9024.33 | 620108.[illegible]73 | 90090.056 | 17238.0[illegible] |
| 1962-63 | 318045.031 | 47769.335 | 9919.766 | 403175.133 | 57110.811 | 10198.36 | 721220.164 | 104880.1[illegible]6 | 20118.1[illegible] |
| 1963-64 | 264379.366 | 39708.926 | 8245.944 | 460771.627 | 65269.505 | 11655.27 | 725150.993 | 104978.431 | 19901.[illegible] |
| 1964-65 | 269997.838 | 40552.802 | 8421.183 | 475477.250 | 58853.438 | 10509.54 | 685474.088 | 99406.2[illegible]0 | 18930.7[illegible] |
| 1965-66 | 227754.115 | 34207.932 | 7103.609 | 456298.013 | 64635.806 | 11542.11 | 684052.128 | 98843.738 | [illegible] |
| 1966-67 | 252798.114 | 37969.450 | 7884.727 | 509980.094 | 72240.013 | 12900.00 | 76278.208 | 110209.[illegible] | [illegible] |
| 1967-68 | 340359.287 | 51120.864 | 10615.744 | 569254.194 | 80636.344 | 14399.35 | 909613.481 | 131757.208 | 2591[illegible] |
| 1968-69 | 284653.141 | 42753.891 | 8878.279 | 580437.907 | 82171.605 | 14682.24 | 865091.048 | 124925.586 | 23560.[illegible] |
| 1969-70 | 315659.9189 | 47411.099 | 9845.375 | 589384.812 | 83487.899 | 14908.55 | 905044.727 | 130898.998 | 24753.9[illegible] |
| 1970-71 | 466064.040 | 70.001.312 | 14536.452 | 597213.637 | 84596.873 | 15106.58 | 1063277.677 | 151598.185 | 29643.03[illegible] |
| 1971-72 | 379528.635 | 57003.976 | 11837.429 | 778950.025 | 110340.307 | 19707.63 | 1158478.660 | 167344.283 | 31541.059 |
| 1972-73 | 356710.738 | 53576.800 | 11125.743 | 772239.604 | 109389.758 | 19533.89 | 1128950.342 | 162966.558 | 30659.633 |
| 1973-74 | 367947.382 | 5526[illegible].507 | 11476.211 | 724708.763 | 102656.891 | 18331.59 | 1092156.145 | 157921.398 | 29807.801 |
| 1974-75 | 307311.703 | 46157.224 | 9584.996 | 697867.701 | 98854.784 | 17652.64 | 1005179.404 | 145012.008 | 27237.636 |

industry, with very small capacities and low extraction rates, they function on seed supply available around the unit only and remain idle most of the year.

Hence the bias in the sample survey in favour of expellers can be justified but even so the results of this paper may at best be taken as estimates and used as a first step till more effective data is available.

Conclusion and Summary

The paper attempts to arrive at some estimates of the total production, value added and employment in the oil milling sector, since there is a complete absence of any data on these three heads, of this very important agricultural industry.

Unless one has some estimates of the growth of this sector, its contribution to GNP and the employment it offers, it becomes very difficult to take any policy decision about the furture of edible oil processing in Pakistan.

The failure of the solvent extraction industry and the large oil losses through expelling [ Appendix D ] further heghten the gravity of the situation.

An attempt has been made to collect in one paper all the information available on the oil processing industry, to uncover some of the reasons for the existing situation and to arrive at some results that might facilitate decision making.

The oil milling sector employed 27238 people in 1974/75 generated a value added of Rs. 145012.008 thousand with a total value of production of Rs. 1005179.404 thousand which shows the importance of this sector. It is amongst the largest of the agro based industries.

The large employment offered by this sector and the value added generated should be taken seriously during decision making in favour of new techniques. There is a need to search for an intermediate technology.

An interesting fact about this sector is that the Kohlus have a value added: value of raw material ratio of 1.1034 and an employment: value of raw material ratio of 0.2803 whereas the more modern expellers have much lower ratios of .16849 and 0.034438 respectively. This is due to fractional running costs of Kohlus and the premium value of their output.

Ways must be found to minimise oil losses, and if the edible oil deficit is to be met internally, the agricultural production of existing crops must be increased and new oil bearing seed crops introduced. Sunflower, Soybean and Safflower offer considerable potential /7/.

Oil losses cannot be reduced simply by increasing expeller efficiency, as increased pressure leads to darkenning of the oil, loss of flavour and burning of the cake. If the oil cake, byeproduct from expelling, can be solvent extracted the oil can very efficiently be extracted.

This can only be done if:

(a) a change can be brought about in the consumption pattern of cattle from oilcake to protein rich meal feeds.

(b) the government fixed oil price be increased from Rs.200/- md oil.

Though there are political considerations involved and it is the Governments endevour to keep the prices of essential commodities at a bare minimum, within easy reach of the common man, subsidy to the price of oil will solve two problems:

(1) It will remove the difficulties being faced by the edible oil industry especially solvent extraction.

(2) The increased price of oil will lead to increased price for oil seeds, which in turn will lead to increased production of oilseeds in the country and encourage the cultivation of new crops.

APPENDIX A

Back Ground

SOLEVENT EXTRACTION

The solvent extraction is a new capital intensive chemical process for the extraction of oil from seed. Though extremely efficient, it leaves only about one to one half percent oil in meal, the process has proved uneconomical due to the high cost of the chemical hexane coupled with almost negligible domestic demand for meal - the bye product, and a persistent down wards trend in the world market prices of the meal.

Because of the economic difficulties described above, solvent extraction is used only on expelled cake (and not wholeseed) mostly of cotton seed and a small amount of Rapeseed /̲ 5, page 54/̲. All solvent mills are equipped with expellers which crush the seed and remove a major portion of the oil. The rest of the oil in cake is then solvent extracted:*

Introduced in 1959, with the sanction of two plants by PICIC, there are at present 17 solvent units in the country /̲ Appendix B /̲. According to the Punjab Industrial Development Board only about 11% of the existing capacity of solvent units was utilized in 1975.

Oil Milling

The bulk of the indegenous production of oilseeds is handled by the oil milling sector. The oiling milling sector is composed of:

*From what I have been able to gather from solvent operators, Rapeseed Contains sulphur which corrodes their equipment; hence the hesitation to process Rapeseed.

(i) Kohlus or Ghanis.

(ii) Power Driven High and Low pressure Expellers.

Kohlus or Ghanis are a part of our tradition. There have been reports of oil crushed by similar devices as far back as Alexander's time.

The traditional mortar and pestle design made of wood and powered by bullocks has survived through centuries of technological change. Though Kohlus, part wood and part stone, and lately all iron, powered by electricity and drawn by belts, do exist side by side. The oil and cakes from these processes are especially prized and fetch premium prices.

In 1964 the Department of Industries, Government of West Pakistan, estimated the number of Kohlus in West Pakistan at 6900 units. But a USAID survey turned up more than 1000 units in an around Gujranwala Town only. A more reasonable estimate, is 15000 units or 1 in every 2 villages /_16_/. The same estimate puts the contribution of Kohlus to total output at 1: 10.

The bullock driven Kohlu working 8 hours a day crushes 1 maund of rape seed, leaving 12% to 14% oil in cake while the power driven Kohlu crushes 1½ maunds rape seed per 8 hours leaving 10% to 12% oil in cake. On the average this process expells only 2/3 of the oil in seed.

The Kohlu incidently does not crush cotton seed.

The high pressure expeller works on the same principle as the low pressure one. It can crush seed to remove oil, leaving only about 4% oil in cake. But the increased pressure causes darkening of the oil and loss of taste which reduces its market value. Hence most high pressure expellers are worked at low pressure except those which are used in line with solvent extraction- First high pressure expelling of the seed to extract oil and then solvent extraction of the cake to get the ramaining oil from the meal. Infact solvent extraction becomes feasible in our conditions only in this way [5, page 54].

The low pressure Lahore type expellers [Anderson Screw type] handle the bulk of the oilseeds processed in the country.

The "Lahore" type low pressure expellers can reduce whole cotton seed to 6% - 7% oil in cake by single pressing and rape seed and mustard seed to the same specifications by double pressing.

The Lahore expeller sells for Rs. 16000/- per unit with a rated capacity of 7½ tons per day of cotton seed or 3½ tons per day of rape seed which means .90 tons of cotton seed oil and 6.60 tons of oil cakes or 1.08 tons rape seed oil and 2.40 tons of cakes.

A USAID expert estimated 3500 units in 1970 [11]. There are 135 expellers made per year, by 3 large manufactures, one of whom claims to have produced 60% of the total number of units produced so far. These concerns started functioning in early 1940's which would imply 3780 units produced since 1947 only. The life of the unit is from 30 to 50 years but parts can be replaced ad infinitum.

A more recent USAID estimate [12] puts the number of expellers at 5000 units with a total aggregate crushing capacity of 25000 tons of seed daily.

No comprehensive survey has been conducted so far to estimate the number of units functioning or of their capacity etc. Though a tremendous amount of interest, exist in this field, at the Government level, heightened by the acute shortage of edible oils and the relative failure of more modern methods of extracting oils.

Oil milling is more feasible economically though it leads to immense losses of oil, because;

(1) It is cheaper to install

(2) Running costs are a fraction of solvent process running costs.

(3) It can be operated at any level of production

(4) It caters to the market around the unit.

(5) Oil cake - the bye product - fetches a good price and an easy market any-where. The large amount of oil residue in cake leads to a bias in-favour of the oil rich cake. Catt Cattle owners in Pakistan do not touch the protein rich but xx oil poor solvent meal.

Oil cake [or residual after oil has been extracted] which makes up from 60% to 80% by weight of the oilseed is by for the most important consideration in the feasibility of any process.

The failure of our oil milling sector to cope with domestic requirements can be attributed to the fact that:

(1) The oil-millers' can only sell the extracted cottonseed oil at the Government fixed price of Rs. 200/- per maund and because of substitutible nature of edible oils the price of all the other oils cannot vary very much above Rs.200/- per maund. This means that the farmer in turn gets a lower price and because of the low yield character of the indeginous oil crops, he gets lower returns per acre for his investment and labour as compared to other cash crops, so he prefers to cultivate only the marginal land for oilseeds.

(2) And the improper and inadequate storage facilities and processing losses which further aggrevate this situation.

There is thus a need to study and compare the solvent extraction and the oil milling, to decide whether a trade off can be brought about between the oil losses incurred through oil milling and the loss of employment which will occur if a shift is effected towards capital intensive solvent extraction; or whether an intermediate technology can be found as a solution to this edible oil problem.

## Solvent Extraction Planst in Pakistan

Sind

(1) Haji Dossa Hyderabad

(2) Oil and Cake Mill Nawabshah

(3) Bengal Oil Mill, Karachi

(4) Burmah Oil Mill, Karachi

(5) E.M. Oil Mill, Karachi

(6) Cowashee Barjorjee, Kotri

(7) Mehboob Industries, Sukkur

(8) Cotton Ginning and Pressing Factory Mehrapur

Punjab

(1) Burewala Textile Multan

(2) Solvex Plant Multan

(3) S. Fazlur Rehman and Sond Multan

(4) Kohinoor Oil Mill Kala Shah Kaku

(5) Universal Oil Mill, Muredke

(6) Grace Industries Kabirwala

(7) United Vegetable Ghee, Lyallpur

(8) Ganesh Mill Lyallpur

(9) Sargodha Mill Lyallpur

APPENDIX C

## Economics of Groundnut Oil Extraction

Oil Recovery

| | | |
|---|---|---|
| Whole seed as is basis | = | 100 mds. |
| Less dockage 6% | = | 6 mds. |
| Balance Clean Seed | = | 94 mds. |
| Less Excess moisture 14% | = | 13.6 mds. |
| Nominal dry seed | = | 80.84 mds. |
| Less Hulls 35% | = | 28.294 mds. |
| Balance Kernel | = | 52.546 mds. |
| 40% oil in Kernal | = | 21.018 mds. |
| Oil recovery actual 38% | = | 18.181 mds. |
| Meal x recovery actual | = | 34.670 mds. |
| | = | Rs . Ps. |
| Cost of 100 md seed @ Rs. 93/- per md. | = | 9300.00 |
| and 20% production transport cost. | = | 1860.00 |
| Total Cost | = | 11160.00 |
| Deduct price of 34.679 md meal @ Rs.45/- per maund. | = | 1560.56 |
| Cost of production of 18.181 md oil | = | 9599.44 |
| 1 md oil | = | 527.99 or 528.00 |

Source: Survey of the possibilities of Development of Groundnut Cultivation and extraction of Groundnut oil in Pakistan, Economic Research Section, Planning Division, Government of Pakistan, 1975.

Note: 1) The seed price is the average price received by farmers and not the wholesale market price which was much higher.

2) The price of Rs.45/- per md of Groundnut meal is assumed. Since no market exists for the commodity it will fetch much lower prices.

3) Solvent extraction rates are used for oil recovery. Milling rates are much lower.

Hence the price of Rs. 528/- per maund of Groundnut oil is a very conservative figure. Actual costs would be much higher.

APPENDIX D

TOTAL SEED IN MANUFACTURE AND OIL LOSSES THROUGH EXPELLING

| Years | Cottonseed | 5% Oil Loss | R M | 7% Oil Loss | Sesamum | 6% Oil Loss | ΣOil Loss |
|---|---|---|---|---|---|---|---|
| 47-48 | 263.16 | 13.158 | 158.24 | 11.0768 | 8.37 | 0.502 | 24.737 |
| 48-49 | 229.10 | 11.455 | 179.40 | 12.558 | 5.58 | 0.334 | 24.347 |
| 49-50 | 294.44 | 14.722 | 130.64 | 9.144 | 5.58 | 0.334 | 24.200 |
| 50-51 | 334.56 | 16.728 | 180.32 | 12.622 | 7.44 | 0.446 | 29.796 |
| 51-52 | 332.52 | 16.626 | 181.24 | 12.686 | 6.51 | 0.390 | 29.702 |
| 52-53 | 424.32 | 21.216 | 115.00 | 8.050 | 5.58 | 0.334 | 29.600 |
| 53-54 | 407.32 | 20.366 | 149.96 | 10.497 | 5.58 | 0.334 | 31.197 |
| 54-55 | 376.72 | 18.836 | 198.72 | 13.910 | 5.58 | 0.334 | 33.080 |
| 55-56 | 399.84 | 19.992 | 202.40 | 14.168 | 5.58 | 0.334 | 34.494 |
| 56-57 | 407.32 | 20.336 | 204.24 | 14.296 | 5.58 | 0.334 | 34.996 |
| 57-58 | 406.64 | 20.332 | 210.680 | 14.747 | 5.58 | 0.334 | 35.413 |
| 58-59 | 377.40 | 18.870 | 264.56 | 17.259 | 5.58 | 0.334 | 36.463 |
| 59-60 | 390.32 | 19.516 | 216.20 | 15.134 | 7.44 | 0.446 | 35.096 |
| 60-61 | 406.64 | 20.332 | 194.12 | 13.588 | 6.51 | 0.390 | 34.310 |
| 61-62 | 433.84 | 21.692 | 185.84 | 13.008 | 10.23 | 0.716 | 35.416 |
| 62-63 | 489.60 | 24.480 | 232.76 | 16.293 | 7.44 | 0.446 | 41.219 |
| 63-64 | 560.32 | 28.016 | 191.36 | 13.395 | 7.44 | 0.446 | 41.857 |
| 64-65 | 505.24 | 25.262 | 203.32 | 14.232 | 8.37 | 0.502 | 39.996 |
| 65-66 | 554.88 | 27.744 | 164.68 | 11.527 | 6.51 | 0.390 | 39.661 |
| 66-67 | 620.16 | 31.008 | 184.00 | 12.880 | 6.51 | 0.390 | 44.278 |
| 67-68 | 692.92 | 34.646 | 248.40 | 17.388 | 8.37 | 0.502 | 52.536 |
| 68-69 | 704.48 | 35.224 | 207.00 | 14.49 | 7.44 | 0.446 | 50.166 |
| 69-70 | 716.72 | 35.386 | 230.92 | 16.164 | 7.44 | 0.446 | 52.446 |
| 70-71 | 726.24 | 36.312 | 243.80 | 17.066 | 9.30 | 0.651 | 54.029 |
| 71-72 | 947.27 | 47.363 | 272.32 | 19.062 | 12.09 | 0.725 | 67.150 |
| 72-73 | 939.08 | 46.954 | 259.44 | 18.161 | 9.80 | 0.651 | 65.766 |
| 73-74 | 881.28 | 44.064 | 264.96 | 18.547 | 11.16 | 0.669 | 64.280 |
| 74-75 | 848.64 | 42.432 | 224.48 | 15.714 | 7.44 | 0.446 | 58.592 |

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