# PROGRESS REPORT
# PROTEIN ADVISORY COMITTEE
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CONTENTS

## 2. SUNFLOWER SEED DEHULLING

### 2.1. Centrifugal Hullers

It has been established that the centrifugal impact huller which was developed at DFST can produce results (hulled sunflower seed) comparable to industrial hullers in South Africa (see PAC report 1987). The trend in Europe (Buhler Miag-Switzerland and Cetiom-France) is towards centrifugal hullers (decorticators). Such hullers offer improved hulling and increased capacities while using less floor space (overseas report).

A number of inquiries have been received from smaller companies interested in small capacity hulling equipment. It appears however, that contrary to National Policy, small sunflower processors will be actively prevented from entering the market by the latest policies of the Oil Seed Board.

### 2.2. Seed Characteristics

A correlation between our laboratory scale huller, the pilot plant huller and industrial hullers was considered necessary. Trials have already been planned and initiated. The results show that the correlation is possible (see Appendix 2). Hulling trials in the future can therefore be undertaken on the laboratory huller and the results can then be related to the pilot plant huller. This will save time and less material will be necessary.

It has been found that it is difficult to produce HPSSM from sunflower seeds with a protein content less than 20 %.

A knowledge of the variation in protein and oil content of the available seed in each batch will therefore be valuable to the oil mills interested in producing Hi-Pro sunflower seed meal. The seed size distribution and the related protein and oil content are the characteristics which are of importance to the manufacturer of HPSSM. It has already been shown that hulling efficiency is decreased by the presence of a large percentage of small seeds. Other characteristics, such as hull to kernel ratio, which are also important to processing of oil seeds, are of more importance in the long term strategic breeding program of sunflower cultivars.

2.3. High Speed Photography

The application of high speed photography to the design of the huller has not been successfully implemented. Preliminary exposures indicated that such techniques were feasible. However, a combination of difficult lighting procedures and unavailability of suitable equipment resulted in the photographs being unsucessful. The CSIR unit responsible for the high speed equipment does not believe that this technique can be implemented in the near future. Similar techniques have however been used by overseas equipment manufacturers and use will be made of this information.

2.4. Conclusions

2.4.1. Centrifugal hulling techniques have been sucessfully implemented.

2.4.2. Seed characteristics related to seed size and oil and protein content are of primary importance to the manufacturer of Hi-Pro sunflower meal.
Other seed characteristics relevant to processing must be investigated in conjuction with long term cultivar development objectives.

2.4.3. Implementation of high speed photography techniques were unsuccessful.

2.5. Recommendations

2.5.1. Funding be requested for determining the relationship between seed size, oil and protein content.

## 3. INDUSTRIAL LIAISON

3.1. Contact with all sectors of the industry involved with HPSSM is still maintained. This includes seed breeders, processors and feed manufacturers.

3.2. All the large processors have been visited (except for Nola Industries) and industrial trials for the production of HPSSM were attended on two occasions. We were favourably received on both occasions and the factory managers were helpful and cooperative.

3.3. The first industrial Hi-Pro trial attended proved to be successful with a 48 % meal being produced. The oil-in-hull loss was low at 6 % (3 % being normal) while no slippage was experienced in the expellers and no percolation difficulties occured during the solvent extraction. We participated in analysis and confirmation of the product composition. The second trial in a different factory proved unsuccessful with only a 46 % protein meal being produced with up to a 10 % oil loss in hull. This manufacturer however appears to be committed to the production of Hi-Pro and we have made various proposals involving novel ideas for their specific application. The feasibility of these proposals is being determined in conjunction with this project team.

3.4. Conclusions

3.4.1. The concept of High Protein sunflower meal has sucessfully been implemented.

3.4.2. The enrichment of sunflower seed meal by means of efficient front-end hull removal can be economically viable, given a seed protein content of at least 20 %.

3.5. Recommendations

3.5.1. Funding be requested for further liaison only if this task is required by the PAC.

## 4. OVERSEAS TOUR OF DUTY

4.1. Dr du Plessis was accompanied by Gary Haylett on a three week visit to equipment manufacturers and research organisations in Europe (see tour report for details). Oil seed processing trends and developments were discussed with experts in Israel, Switzerland, Italy, France and West Germany.

4.2. We are pleased to report that the South African research and development is keeping up to date with the latest developments and that the present research is of a similar standard to work in Europe.

4.3. South Africa is apparently unique in its requirements for utilization of HPSSM in chicken feed. S.A. is therefore the world leader in the field of upgrading sunflower meal to produce a protein enriched feed stock.

4.4. Conclusion

4.4.1. S.A. has the technology and expertise to sucessfully implement production of HPSSM.

4.5. Recommendation

4.5.1 Implementation of enriched sunflower meal be actively promoted.

## 5. ELECTROSTATIC SEPARATION FOR PRODUCTION OF HPSSM

Preliminary investigations of two possible methods of endpoint protein enrichment were conducted during the past two years - namely sieving and electrostatic sorting. The goal for 1988 was to manufacture and test a panel for electrostatic sorting on a laboratory scale, from information in the literature.

### 5.1. Manufacture of Electrostatic Sorting Panel

Four industrial sunflower meals were ground to a fineness of less than 1 mm (at least 90 % of the sample). The dimensions of the electrostatic panel were chosen for this particular particle size (i e width of conductors and spaces between them).

Various materials were evaluated for their suitability to use as conductors or supporting material; eg conducting paint, conducting wires, Perspex plate etc. The materials used eventually were a PC-board etched with an accurate design of the conductors and covered with a non-conducting resin. The finished board was provided with a stand and wires to be connected to the high-voltage source (see photographs, Appendix 3). Care was taken to prevent leakage of current.

### 5.2. Preliminary electrostatic separation trials

Four industrial sunflower meals were used in the trials to confirm that some reaction was possible. Movement of the particles did take place and no sample was left on the board. A small fraction was obtained at one end of the panel and the major fraction at the other end. The voltage was varied between 8 and 12 kV. A variation in the voltage had a definite effect on the speed of movement of the particles. The mean masses of the fractions obtained at either end of the panel are presented in Table 1 (Appendix 3).

Particles of dried samples displayed less movement than samples with the original moisture content. Protein content of selected samples were determined, but no large increase in protein content was obtained in any fraction (Table 2, Appendix 3).

Samples with a very small particle size displayed very little movement; the panel dimensions are therefore not suitable for these particle sizes.

It must be emphasized that the results (Tables 1 and 2) of these preliminary trials are not conclusive, because optimized conditions have not been used.

5.3. Conclusions

5.3.1. A power source which can supply a constant voltage is needed.

5.3.2. The results of the preliminary trials proved that the panel that was manufactured was operational, but no conclusions can be made about the degree of enrichment that is possible. The optimum conditions for the enrichment of sunflower meal still have to be determined.

5.3.3. The dimensions of the board determine the size of the particles that can be separated.

5.4 Recommendations

5.4.1. That specific boards for each specific particle size to be investigated, be manufactured.

5.4.2. That funding be obtained to allow the determination of the optimum conditions for the enrichment of sunflower meal. This will include the manufacture of a suitable high voltage source.

5.4.3. That other applications beside sunflower meal be investigated (eg soya).

## 6. SOLVENT EXTRACTION APPARATUS

6.1. This apparatus is necessary for producing HPSSM on a pilot plant scale for further trials (including production of material for feeding tests). Extensive enquiries were made in Europe for small capacity solvent extraction equipment. It was apparent that importing the equipment will be too expensive. We will therefore proceed with local designs and constructions. We are also attempting to generate additional funding for this apparatus from other sources. Initial funding from a private company has unfortunately been withdrawn. There are indications that the Oil Mills are unwilling to support this project. Numerous motivations for funding from the Oil Seed Board have been rejected as a result of this attitude. The Division for Food Science and Technology has allocated some additional funds. Provision has also been made for space and service facilities necessary in the Divisions new pilot plant which is presently under construction.

6.2. Conclusion

6.2.1. Equipment and technology for pilot plant scale extractor is unavailable.

6.3 Recommendation

6.3.1 Local design and manufacture be used.

## 7. FEEDING TRIALS

7.1. Preliminary trials were conducted at Irene, Stellenbosch and the CSIR in 1986 with sunflower presscake produced by the CSIR. Presscakes with three different protein levels (46 %, 49 % and 53 %) were produced for the trials. The results were positive, but the chicken rations had a high energy content, since the ooil was not extracted from the presscake.

After long negotiations to decide whether or not further trials were necessary, arrangements have been made with Professor J. Hayes from Stellenbosch, who will conduct another set of feeding trials with broiler chickens and hens. Extracted sunflower meals containing 47 % and 39 % protein respectively, will be used as part of the chicken rations. Independent trials with extracted sunflower meal will be conducted at Irene also.

7.2 Recommendations

7.2.1. DFST be involved in the production of material for feeding trials.

7.2.2. That the effect of chlorogenic acid on the growth rate and egg production of chickens be investigated.

APPENDIX 1

Articles published in the Oil Seed News.

1. De Villiers, J.B.M., Du Toit, L.J. and Haylett, G.G., 1987. Sunflower can be chicken feed. Oil Seed News, April, 6.

2. De Villiers, J.B.M., Du Toit, L.J. and Haylett, G.G., 1987. Dopping van sonneblomsaad. Olie Sade Nuus, Junie, 6,7,9,10.

3. De Villiers, J.B.M., Du Toit, L.J. and Haylett, G.G., 1987. Skroefpersing van olieryke sade. Olie Sade Nuus, Desember, 18,19.

4. De Villiers, J.B.M., Du Toit, L.J. and Haylett, G.G., 1988. Utilization of low-fibre sunflower protein oil cake. Oil Seed News, March, 4-5.