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Summary of Results Pea Tenderometer Tests

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The findings in this report are not to be construed as an official Agriculture Canada position.

SUMMARY OF RESULTS - PEA TENDEROMETER TESTS

1968 - 1969

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SUMMARY

Because of the way the pea tenderometer is designed and functions it is not practical to improve its accuracy of measurement. At present the differences among processor's tenderometers is too great to apply the marketing agreements equitably to both the processor and grower. It is time the instrument was replaced by a machine which does not have the problems inherent in the pea tenderometer. The Ottawa Pea Tenderometer is a suitable replacement. A proposed procedure to apply this instrument and certify it for grading peas under current agreements is given.

1. INTRODUCTION

It is now generally understood that the accuracy of pea tenderometers used in Ontario to establish the price paid to pea growers is open to questioning. Tenderometer accuracy is critical to all concerned in that the grower must be paid for his crop according to the negotiated marketing agreements and fair competition between processors must be maintained. This can only be achieved in theory if all tenderometers give the same reading for the same peas.

Engineering Research Service and the University of Guelph were requested to investigate the situation to determine if machines throughout the Province were comparable to one another and if not to provide a solution. Reports have been issued as the work progressed (see section 5, numbers 2 to 8) and results published (numbers 1 and 10 to 15). The purpose of this report is to summarize this mass of data and provide an outline on which to base future decisions. Justification for the statements made is not given as this is already contained in the references listed.

The basic problem with the tenderometer is calibration which can be considered in two parts: a) the accuracy of the force indication system which can only be checked within broad limits; b) the condition of the blades shearing the peas which at present is not and cannot be verified accurately at the processors' grading station.

2. DISCUSSION

2.1. The Present Situation

The pea tenderometer is the only instrument used in the Province to apply the marketing agreement. It is rugged and practical but because

of the way it is designed:

a) the indicated reading is not the precise force required to shear the peas;

b) it is difficult to verify accuracy under operating conditions;

c) the existing machines are not all made to the same specifications;

d) because the shearing blades are built into the machine their adjustment or replacement is costly;

e) not all the processors maintain their machines adequately and an overall improvement has not been observed.

The design and construction faults and in a few cases poor maintenance introduce differences among tenderometers that affect the price paid for peas. This has been demonstrated with wax where differences ranging -15 to +33 T.U. have been found and more realistically found to be -11 to +13.5 T.U. in testing peas. These differences are based on average results for the Province and are real. Current inspection procedures do not detect these errors because the techniques required are not available to the inspector.

A distinct problem is that a standard does not exist (e.g. a standard pea or pea tenderometer) in the Province. Thus it is not known which machine is correct--only that the machines are different.

The work has not indicated a simple economic solution to this problem. It is not feasible to check and certify the machines at their widely dispersed locations because a suitable standard test material has not been found. The only material approaching the requirements would be fresh peas of the same variety, which would be costly to arrange. Even then

to apply corrections, the machines would have to be adjusted incorrectly (position of weights)--an undesirable situation.

It is, therefore, concluded that the only economic solution is to retire the pea tenderometers and replace them with a better instrument.

2.2. Replacements that are Available

There are two machines available: a) the tenderometer model of the Texture Test System, Food Technology Corp., Rockville, Maryland; b) the Ottawa Pea Tenderometer, Canners Machinery Ltd., Simcoe, Ontario. The Ottawa Pea Tenderometer has technical and economic advantages and is the recommended replacement. The performance of this machine has been exhaustively tested and development continued throughout the tests to optimize its operation and performance under grading station conditions. The machine offers the following improvements over that of the pea tenderometer:

a) the force to shear the peas at a constant rate is precisely indicated by easily "on site" calibrated electronic equipment;

b) the test cell is a separate removable unit, easily replaced at reasonable cost, that can be brought to a central location for comparison with all other cells in use. Two cells supplied with each machine (or a greater number) effectively makes a single machine equivalent to two averaging out small errors that may exist in the cells;

c) The average total testing time per sample of the new machine is 1.2 minutes compared with 1.0 minute for the pea tenderometer.

2.3. The Varietal Effect

The relationship between readings from different types of instruments (and possibly instruments of the same type) is affected by variety of peas used to make the comparison. The relationship changes slightly within a season or from season to season. A conversion factor to change the pricing agreement from the pea tenderometer to the Ottawa pea tenderometer with an accuracy better than ± 2 T.U. can be provided to cover most of the important varieties grown in Ontario. The maximum error considered possible is ± 4 T.U. The changeover procedure would involve converting the present pricing scale to the new units of measurement using a conversion factor agreed upon for this purpose.

2.4. Certification of Instruments

No matter which instrument is used a reliable procedure must be established to test the performance and accuracy of all the instruments in operation. This procedure must be simple, easy to accomplish and be inexpensive but verify the accuracy of the force indicating system and the condition of the components shearing the peas. All these requirements cannot be met with the pea tenderometer but they can with the Ottawa Pea Tenderometer. Once such checks can be performed quickly and routinely each instrument can be certified for use.

3. CONCLUSION

It is concluded that there is no simple solution to the current situation that will offer any significant improvement in the accuracy of measurement if the pea tenderometer remains in use. The time has arrived

when the pea tenderometer has served its useful life and replacement is necessary. The Ottawa Pea Tenderometer is available as a replacement and because it uses modern technology the existing faults in the pea tenderometer do not occur with this instrument.

4. A PROPOSED SOLUTION

Any instrument used for grading peas requires proper calibration and certification for use and the following proposal will apply no matter what type of replacement was used. With modification the procedure could be applied at great cost and with less reliability to the pea tenderometer because of shipping problems. An independent official agency should be involved as is the present case.

The procedure recommended is as follows:

1. Each processor is equipped with an Ottawa Pea Tenderometer (cost about $3800, E.R.S. estimate). This has a built-in calibration mechanism for the force indicator so that checks can be made in about 5 minutes at any time using certified weights. The calibration is also checked automatically before testing each sample.
2. The independent agency has one Ottawa Pea Tenderometer (or more if necessary) and has two test cells for each processor plus spare cells as required (cost about $185 each). Just prior to the season all the cells are compared by testing samples from the same batches of peas following a rigid statistically sound procedure. This would be done on at least two batches, one at about 90 T.U., the other at about 1 5 T.U. to cover that portion of the scale used. Any cell deviating from the average reading by a speci-

fied amount would be repaired (replace the wire grid for about $40). Two cells would then be delivered to each processor.

3. During the season inspectors could visit the plants periodically and a) check that the force indicator was being calibrated correctly;
   b) compare readings from the cells used by the processor with other cells kept by the inspector for the purpose. If the processor's cell was in error (within prescribed limits) it would be replaced with another cell from the group initially compared by the agency at the start of the season and so on.
4. The official agency would also maintain a number of spare electronic components so that in the event of a breakdown the processor could exchange the complete electronic package and send the broken one for repair.

The costs of the above procedure would be higher than the present. However, once staff were trained and the procedures became routine the increase in cost should not be great. The additional work involved would be the initial comparison of the cells which it is estimated would take about 4 to 6 man days. As experience was gained and data accumulated the frequency of the initial comparisons and inspections could probably be reduced as it is predicted that the cells would maintain interchangeability.

Proper arrangements and packaging designs would have to be developed to ship the components to the processors.

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