1-1-1963

Hints on sampling premium wheat crops

J A. Parish

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Cover Page Footnote
Acknowledgment is made of financial support for the work described in this article by a grant from the Wheat Industry Research Council.
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Hints on . . .

sampling premium wheat crops

Cereal Products Adviser J. Parish, B.Sc. (Agric.), describes how samples can overestimate the quality of a crop and suggests methods of taking samples which will give a true estimate of crop quality.

Each year much of the premium wheat received by millers is inferior in quality to the samples on which the premium bids are based. This often leads to reduction in the premium paid.

Difficulty in sampling is often the cause of this and the work reported in this article was undertaken in an attempt to help farmers obtain more representative samples from their premium wheat* crops.

In recent years premiums have been paid on approximately 300,000 bushels of high protein wheat for bread making. Premiums have also been paid for low protein wheat for biscuit making, but this article is concerned only with the high protein wheat purchased for bread making.

Although this high protein wheat is only a small amount—about 0.5 per cent. of receivals—it is important to—

- **Millers**, because it enables them to supply a demand for flour of quality suitable for breadmaking.
- **Bakers**, because it allows them to obtain better flour for bread making.
- **Bread consumers**, because it provides them with bread of far better quality than that which could be baked from f.a.q. wheat.
- **Farmers**, because the premium paid gives a profit margin over and above that obtained for normal f.a.q. wheat.

**PREMIUM WHEAT RECEIvals FOR THE SEASONS 1957-58 TO 1962-63**

<table>
<thead>
<tr>
<th>Year</th>
<th>Bushels.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1957-58</td>
<td>301,407</td>
</tr>
<tr>
<td>1958-59</td>
<td>208,872</td>
</tr>
<tr>
<td>1959-60</td>
<td>596,961</td>
</tr>
<tr>
<td>1960-61</td>
<td>232,835</td>
</tr>
<tr>
<td>1961-62</td>
<td>292,026</td>
</tr>
<tr>
<td>1962-63</td>
<td>350,426</td>
</tr>
</tbody>
</table>

Source—The Grain Pool of W.A.

Requirements for Premium Wheat are:

1. High protein.
2. Suitable variety.
3. No mottling.
4. Low foreign matter content.

Although a requirement for certain varieties may not be stated by millers, it is known that varieties such as Gabo and Wongoondy are superior for bread making and we can be sure that grain of such varieties, other things being equal, will be preferred where the premium wheat is to be used for bread making.

The following Table lists the varieties and percentage of premium wheat deliveries in the 1962-63 season.

* In this article “premium wheat” refers to high protein premium wheat purchased for bread making.
The relationship of grain protein levels is shown opposite

<table>
<thead>
<tr>
<th>Variety</th>
<th>Percentage</th>
<th>Average Premium (Per Bushel)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>Gabo</td>
<td>87.45</td>
<td>1</td>
</tr>
<tr>
<td>Koda</td>
<td>5.4</td>
<td>1</td>
</tr>
<tr>
<td>Wongoondy</td>
<td>4.5</td>
<td>1</td>
</tr>
<tr>
<td>Mengavi</td>
<td>1.55</td>
<td>1</td>
</tr>
<tr>
<td>Dirk</td>
<td>0.75</td>
<td>1</td>
</tr>
<tr>
<td>Festival</td>
<td>0.35</td>
<td>2</td>
</tr>
</tbody>
</table>

Source—The Grain Pool of W.A.

It is not worth sending in samples if it is known that the wheat being sampled has any appreciable content of mottled grains.

**Procedure in Making Bids**

A farmer who wishes to obtain a premium sends a 10 lb. sample to the Grain Pool, enclosing in the sample a slip of paper showing his name, address, siding of delivery, variety, and quantity available.

This sample is divided into smaller subsamples, one of which is retained for possible use in arbitration. The other samples are sent to mills interested in premium wheat. These mills examine the samples and if they wish to purchase the wheat, offer a premium bid.

The best of these offers is then communicated to the farmer by the Grain Pool and if this is acceptable to the farmer the Grain Pool arranges for the receipt of the wheat into railway trucks which are despatched direct to the mill.

The wheat received at the mill is examined at the time of receipt by the miller and if he considers it up to the standard of the sample the agreed premium is paid. When he considers it not up to standard the miller lodges a claim for a reduction in his bid.
The matter is then referred for arbitration, in which the sample retained by the Grain Pool is examined and compared with samples of the wheat delivery. A representative of the Grain Pool thoroughly samples each truck load claimed to be below sample and, in the presence of the miller, seals the samples taken.

For the purpose of arbitration the wheat is examined for—

- Protein content (by the Kjeldahl method).
- Zeleny test.

A sliding scale which involves the use of both protein content and zeleny test value is used by the arbitrators to decide whether the wheat received is inferior to the samples submitted. The scale also indicates the amount by which the bid should be reduced if the wheat submitted is below the sample in quality.

**Variation in Protein Content of Grain**

Most farmers are unaware of the amount of variation which occurs in the protein content of their wheat crops. Protein content is affected markedly by many factors. Some of the important ones are:

- Rainfall.
- Soil moisture relationships.
- Variations in inherent soil fertility.
- Effects of previous crops and pastures.

Probably the most important factor causing variation in grain protein within any one paddock is soil variation. There are a host of edge effects so that sampling from the outside, as is normally done, can often give an incorrect answer.

Many edge effects do favour high protein content in grain and the result is that samples taken from the edge tend to over-estimate the amount of protein in the grain.

**SAMPLING EXPERIMENT**

In order to compare different sampling methods, 273 samples were taken from a paddock of wheat grown at the Merredin Research Station in 1962, and were analysed for protein content. It is realised that millers are also interested in protein quality but in almost all cases where arbitration is sought the cause of the trouble is that the protein content of the grain received is lower than that of the sample forwarded.

The purpose of this study was to help farmers to obtain samples of grain which are truly representative of the areas of crop sampled.

**Sampling of Paddock 5C at Merredin Research Station**

As can be seen from the attached maps this is a long narrow paddock with a creek running through it. On the west side the soils are the heavy sandy clay loams of the Merredin association. At the east end
McCormick International A1-41 Disc or Mouldboard plough in two, three or four furrows, or single 14 in. mouldboard for specialised application, is ideal for use in most types of country. Disc or mouldboard units are readily attached to the beam which has adequate holes to facilitate width spacing. The two-in-one backbone— the strength of any plough— features "hat section" of immense strength with a wide mounting face for rigid attachment of either disc or mouldboard units. Contact your local IH dealer now!

Two-in-one backbone

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the soils are the lighter textured loam and sandy loams of the Booraan association.

The following grain samples were taken from this paddock immediately before harvesting or at the time of harvesting in December, 1962.

(a) Immediately before harvesting 233 samples were taken by hand on a grid basis throughout the paddock. The sampling points were 1½ chains apart.

(b) Twenty samples, each taken from a 12 chain length of a run around the outside of the paddock with a harvester.

(c) Ten samples, each taken from a 25 chain length of the second run of the harvester.

(d) Ten samples, each taken from a 25 chain length of the third run of the harvester.

Discussion of Results

Results of analyses for protein content are given in the Table. The maps show the relationship of the areas of low protein samples with areas of light soil.

It is thought that the relationship between soil type and grain protein in this instance is due largely to better moisture relationships of the Booraan association. This was a season in which moisture supply of the more sandy soil was responsible for a much higher yield. There would also be some effect of soil fertility as the soils of the Merredin association would have a higher nitrogen status than the other soil types in the paddock.

Because of the comprehensive sampling the average of the analyses of the 233 samples from the grid is a reliable determination of the protein content of the crop.

The average of the samples from the third run of the harvester would also be satisfactory, for this particular paddock.

The average (13.3) of the samples from the first run of the harvester indicates that an analysis of a good mixed sample of the wheat from this run would have over-estimated the average of the paddock, by 0.4 per cent. protein. If a claim for reduction in premium were to be lodged for such a difference then any reduction in premium would be quite small.

The average (13.6) of the second run is less satisfactory, being 0.7 per cent. protein above the correct value, and on the other hand the average of the third run indicates that an analysis of a good mixed sample from this round would be identical with the true average of the paddock.

From the individual values given for the first run in column 1 we can see the sort of over-estimation which is likely to occur when a sample is taken from one run of the harvester along one side of the paddock. Each of the first nine values, for samples taken from a 12 chain length on the first round is well above the paddock average, the eighth one being 2.8 per cent. protein above. The average of these first nine values covering the length of 108 chains is 15.1 per cent., or 2.2 per cent. protein above the paddock average.

Results of statistical analyses showed that in this particular paddock the grid sampling gave a reliable prediction of the average within ± 0.2 per cent. protein (95 per cent. confidence limit). Four samples to the acre were taken on a grid so that the distance between sampling points was 1½ chains.

### GRAIN PROTEIN VALUES OF SAMPLES FROM PADDOCK 5C MERREDIN

<table>
<thead>
<tr>
<th>1st Harvester Run</th>
<th>2nd Harvester Run</th>
<th>3rd Harvester Run</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.39</td>
<td>14.81</td>
<td>15.68</td>
</tr>
<tr>
<td>15.70</td>
<td>15.78</td>
<td>15.62</td>
</tr>
<tr>
<td>14.29</td>
<td>15.44</td>
<td>12.96</td>
</tr>
<tr>
<td>15.40</td>
<td>8.58</td>
<td>7.42</td>
</tr>
<tr>
<td>14.92</td>
<td>7.91</td>
<td>7.92</td>
</tr>
<tr>
<td>13.77</td>
<td>12.92</td>
<td>13.59</td>
</tr>
<tr>
<td>15.41</td>
<td>14.12</td>
<td>13.91</td>
</tr>
<tr>
<td>15.70</td>
<td>15.99</td>
<td>15.33</td>
</tr>
<tr>
<td>15.42</td>
<td>15.02</td>
<td>14.66</td>
</tr>
<tr>
<td>10.79</td>
<td>15.52</td>
<td>12.26</td>
</tr>
<tr>
<td>12.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.58 Av. = 13.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.84</td>
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<tr>
<td>15.64</td>
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</tr>
<tr>
<td>15.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.76</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Av. = 13.26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Grid Samples**

Ranged from 6.9 to 17.1
Average = 12.91
Half of this number would be sufficient to give a prediction of the average ± 0.4 per cent. protein which would be satisfactory for premium wheat sampling.

In this particular instance the reason for higher grain protein values towards the outside of the paddock is almost certainly a difference in soil type with a combination of soil fertility factors and soil moisture favouring high protein levels towards the outside of the crop and lower protein towards the inside.

In this season soil fertility and soil moisture conditions caused the crop to be very variable in yield and in protein content. The best yielding patches were on the lighter soils adjacent to the creek towards the east end of the paddock. Grain protein values were low in this area and were highest in the north-western corner. Grain protein values for the 233 samples taken on the grid basis ranged from 6.9 per cent. to 17.1 per cent.

In practice it would not be advisable for farmers to take premium wheat from a paddock as variable as the survey one. From more uniform paddocks suitable for supplying premium wheat it would be sufficient to take one sample per acre on a grid basis. The best paddocks to use are those where no very marked soil variations can be seen.

Where farmers wish to take premium wheat from a paddock as variable as the survey one they must take considerable trouble to—

1. Obtain a good sample.
2. Mix the wheat from the areas of differing fertility so that they obtain reasonably even truck loads of wheat. It is necessary for truck loads to be even as a miller can appeal for arbitration on any truck load which he considers below sample.

RECOMMENDED METHODS OF SAMPLING

- The best method of sampling is to cover the paddock on a grid basis taking as many sampling points as possible. At each sampling point a handful of heads is picked and care is taken that there is no discrimination against any particular type of head.

From the results of this study it is clear that four samples per acre would be sufficient to give an estimate of the average correct to within plus or minus 0.2 per cent. protein from paddocks as variable as the survey paddock. Smaller numbers would be sufficient on more uniform soils.

For most situations using a similar grid basis one sampling point per acre would be sufficient.

Such sampling must be done by hand and 10 lb. of grain threshed from the wheat heads. This could take up to one day for a 200 acre paddock.

- Farmers owning an auto header would find it best to take a number of strips through the paddock taking many small subsamples from the grain obtained. When sampling this way the farmer should take care to see that the header crosses any obvious lines of different soil types and topography instead of going parallel with such lines.

ACKNOWLEDGMENT

Acknowledgment is made of financial support for the work described in this article by a grant from the Wheat Industry Research Council.
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