The New Method for Grading Collaborators in the Smalley Check Sample Series

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During the season of 1962–63, the Smalley Committee, through 6 subcommittees, distributed over 4,000 samples of oilseeds, fats, oils, and related products for check testing by 479 subscribers. Over 6,000 results were tabulated and graded in determining the Smalley Awards. The following tabulation lists the types of samples and the extent of the participation by the collaborators.

Series	Number of collaborators	Number of samples	Graded tests per sample
Cottonseed	38	10	5
Soybean	31	10	2
Peanut	13	7	4
Meal	134	15	3–4
Vegetable Oil	86	6	3
Tallow and Grease	78	5	6
Glycerine	24	5	4
Drying Oil	20	6	4
Edible Fat.'	56	5	7–10

A uniform method to determine scores of the collaborators in each series has been adopted by the Smalley Committee for use during the 1963–64 season. The method is applicable to the scoring and ranking of the participants in any collaborative test where numerical values can be given for the analytical results.

Fundamentally, the scores are calculated by relating the results of the individual laboratory to the average of results reported by all the laboratories.

The Sample Report

Results of the collaborators for each sample are tabulated by the series subcommittee and the *sample report* is sent to each laboratory. In order that this report can be made out completely, it is necessary that each laboratory send in its results within a set time limit. A representative report is shown in Table I.

The analyses shown in Table I under "moisture" and "oil" are generally the average of 2 or more determinations made on the sample and may be considered to be the *laboratory mean* for each particular laboratory.

Often in analyses made on the same sample by different laboratories, some results will not follow the pattern. Such "wild" analyses, designated "b" in Table I, are not used in the calculations of the *sample mean* and the *average deviation*.[1] An average deviation is then calculated, and any reported analysis with greater than 3.7 average deviation from the mean is also eliminated. Such an analysis is designated "a" in Table I.

The sample mean and average deviation are then determined (lower box of the Table). The range of the analyses used in these calculations is also shown.

The score for each of the two characteristics (moisture and oil in this instance) is determined from the difference of the sample and laboratory means (a description of this procedure follows in the discussion of Table II, "The Laboratory Work Sheet"). In order that each laboratory may estimate its own scores on each sample during the series, Table II also gives several of these differences in terms of equivalent scores. The decrease in score for every 0.1% increase of difference is 75.02 for moisture and 77.76 for oil.

TABLE I

Representative Report to Laboratories of Results on Sample Number 1 of Soybean Series

Laboratory number	Moisture	Oil	Laboratory number	Moisture	Oil
1	9.2	18.8	16	9.1	18.8
2	9.2	19.0	17	9.8 [a]	18.5
3	9.0	18.8	18	9.2	18.8
4	9.0	18.8	19	9.1	18.9
5	8.9	18.9	20	9.6	19.0
6	9.1	19.0	21	9.1	18.7
7	9.6	18.8	22	9.2	18.8
8	9.3	19.3	23	9.0	19.0
9	9.1	18.7	24	8.8	19.0
10	9.4	18.6	25	9.3	18.7
11	9.1	19.1	26	9.1	18.9
12	9.2	19.2	27	10.5 [b]	20.5 [b]
13	9.3	18.8	28 [c]	....	....
14	9.2	18.7	29	9.1	18.7
15	9.1	18.8	30	9.3	18.7

[a] Not used in calculations of sample mean and average deviation—greater than 3.7 average deviations from mean.
[b] Not used in calculations of sample mean and average deviation—determined by observation.
[c] No report received.

Calculated data on sample number 1

	Moisture	Oil
Sample mean	9.2	18.8
Average deviation	±0.1333	±0.1286
Range used in calculations	8.7–9.7	18.3–19.3
Scores by difference of sample mean and laboratory reported mean:		
0	100.00	100.00
±0.1	24.98	22.24
.2	−50.04	−55.52
.3	−125.06	−133.28

The Laboratory Work Sheet

The subcommittee maintains a work sheet for each laboratory during the series. The final results are tabulated on the work sheets, which are sent to the laboratory at the end of the series.

The method of calculating the score from the "ratio of difference to *the average deviation*" is as follows:

1) If the "ratio . . ." equals zero, the laboratory made a perfect test and the score is 100.00.
2) If the ratio is less than 1, multiply the ratio by 100 and subtract from 100, which gives a plus score.

TABLE II

Representative Work Sheet of each Laboratory in the Soybean Series.

MOISTURE

No.	Average deviation	Mean	Reported laboratory mean	Difference of means	Ratio of difference to average deviation	Score
1	.1794	9.2	9.2	0	0	100.00
2	.2715	8.7	8.5	−0.2	.7366	26.34
3	.1931	7.3	7.4	+ .1	.5179	48.21
4	.2508	12.0	12.1	+ .1	.3987	60.13
5	.1887	7.2	7.1	− .1	.5299	47.01
6	.1349	7.4	7.4	0	0	100.00
7	.2025	6.4	6.4	0	0	100.00
8	.2227	12.2	12.1	− .1	.4490	55.10
9	.1685	6.3	6.4	+ .1	.5935	40.65
10	.3266	5.4	5.4	0	0	100.00
					Average	67.74

OIL

1	.1775	18.8	19.0	+0.2	1.1268	−12.68
2	.1631	19.5	19.7	+ .2	1.2262	−22.62
3	.2569	18.0	18.2	+ .2	.7785	22.15
4	.2766	19.2	19.2	0	0	100.00
5	.2307	20.1	20.7	+ .6	2.6008	−160.08
6	.1962	18.1	18.2	+ .1	.5097	49.03
7	.2373	17.9	17.9	0	0	100.00
8	.2254	18.8	18.9	+ .1	.4437	55.63
9	.1612	18.5	18.7	+ .2	1.2407	−24.07
10	.2223	20.1	20.2	+ .1	.4498	55.02
					Average	16.24

	Score	Rank
Moisture	67.74	1
Oil	16.24	11
Total	41.99	5

[1] If standard deviation is to be used instead of the average deviation, any reported analysis greater than 3 standard deviations is also eliminated from the calculations of the *sample mean*. The standard deviation is a form of average deviation from the mean; in approximately 2 out of 3 cases, the variation in the analyses among the laboratoris would be within plus or minus the percnetage points indicated. The formula used here is:

$s = \sqrt{\Sigma X^2/N - 1 - (\Sigma X)^2/N(N-1)}$ where,

s = The standard deviation.
ΣX^2 = Sum of the squares of all the analyses.
$(\Sigma X)^2$ = Sum of all the analyses squared.
N = The number of the analyses.

TABLE III
Representative Final Summary of the Soybean Series

Laboratory number	Moisture		Oil		Total	
	Score	Rank	Score	Rank	Score	Rank
1	53.25	2	72.70	1	62.98	1
31	42.16	3	40.78	5	41.47	2
14	17.59	8	62.47	2	40.03	3
15	16.91	9	52.81	3	34.86	4
2	53.38	1	—18.27	18	17.56	5
4	35.21	6	—1.64	15	16.79	6
16	31.44	7	—8.48	16	11.48	7
18	39.05	4	—20.30	19	9.38	8
19	7.92	13	6.88	11	7.40	9
9	38.39	5	—25.89	21	6.25	10
22	—30.73	23	36.91	6	3.09	11
20	—23.89	19	27.58	8	1.85	12
3	—25.86	20	27.93	7	1.04	13
21	1.18	14	—1.00	13	.09	14
24	—11.29	16	2.94	12	—4.17	15
5	—32.40	24	8.50	10	—11.95	16
7	—78.11	26	51.12	4	—13.49	17
6	15.11	11	—43.00	22	—13.94	18
10	—16.47	17	—20.76	20	—18.61	19
11	15.86	10	—72.08	24	—28.11	20
12	—6.36	15	—97.79	26	—52.07	21
30	—21.73	18	—85.49	25	—53.61	22
23	—95.25	27	—14.61	17	—54.93	23
17	—43.59	25	—118.66	29	—81.12	24
26	12.62	12	—1.47	14	.....	....
27	—30.10	22	12.14	9	.....	....
13	—26.58	21	—61.95	23	.....	....
8	—204.89	28	—111.40	27	.....	....
29	—244.35	29	—113.29	28	.....	....
28	.....	....	.....	....	...	....

3) If the ratio is more than 1, multiply the ratio by 100 and subtract 100, which gives a minus score.
4) If the ratio is 1, the score is zero.

In other words, a plus score indicates that the difference between the sample mean and the reported mean is less than the average deviation; a zero score indicates a difference exactly equal to the average deviation; and a minus score indicates a difference greater than the average deviation.

The *Score and Rank* box at the bottom of the Table contains only those characteristics evaluated for the Smalley Award. (Some of the series may show scores for other characteristics on the work sheet, which are not included in the Smalley Awards.) Furthermore, this box is filled out completely only when the laboratory has tested all the samples in the series for all the characteristics evaluated for the awards, and a score for each characteristic on each sample is shown in the score column of the Table. (If the laboratory reports an analysis which is greater than 6 average deviations from the sample mean, no score will be shown in the score column.) If less than 60% of the samples are tested-and-shown for any characteristic, no average scores will be calculated. If every characteristic is not tested-and-shown, no score or ranking will be tabulated in the Score and Rank box. However, only average scores may be shown for a characteristic.

The laboratory work sheet summarizes the work of the individual laboratory for the entire series. This information can be compared with previous series' reports, and also indicates the laboratory's accuracy during the season. For example, the sample work sheet (Table II) shows that the difference of the means for oil content were consistently higher than for moisture.

The above report (Table III), which is sent to all collaborators in the series, is a summary of the data in the Score and Rank boxes shown on all the work sheets, except that a ranking for each of the characteristics is given. Note that laboratory No. 28 in the Table did not have enough results reported to require any of the calculations.

Summary and Conclusions

Some of the more important advantages of the new method over previous methods used in grading the Smalley series are as follows:

1) The new method can be applied uniformly to each of the series.
2) The calculations involved are simple and are not based on empirical interpretations.
3) No penalty points, based on predetermined tolerances for the variations around the means, are used. Thus each laboratory is scored according to its proficiency

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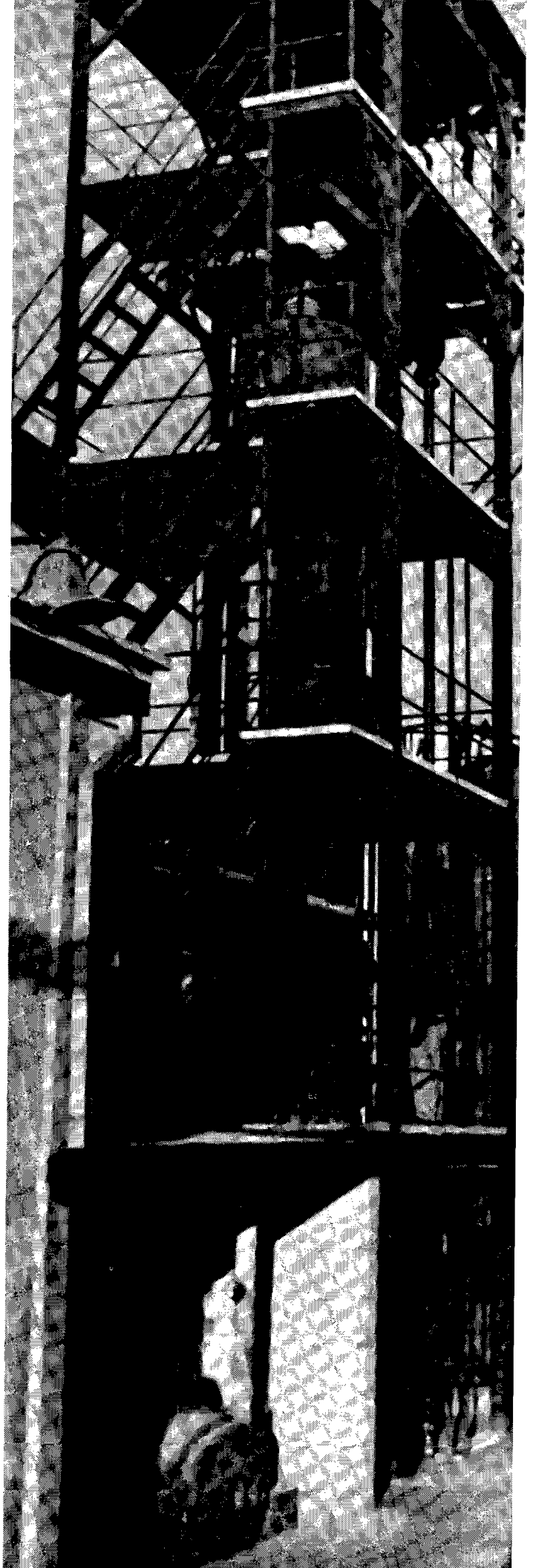

I.A.S.C. President's Review . . .

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tion is making the richest area ever known to the whaling industry virtually uneconomic. It is said that it will take eight years to regenerate the stock of whale in this area, dependent on a complete ban on all whaling for that period of time. It is an ill wind that blows nobody any good!

Quality of Raw Materials

One of the most important functions which this Association can perform is the constant watch over the quality of the raw materials used by our industry. We have seen over the years how perpetual pressure spurred on others to find ways and means of improving the primary product and the methods of shipment.

But one cannot relax, for quality will never be perfect.

a) *Copra.* In this last year, the quality of Philippine Copra has certainly not improved, and it compares unfavourably with much of the copra from other sources. From returns received from some of our members giving oil, FFA and moisture content of shipments arriving in Europe in 1961 and 1962, the quality difference between Philippine Copra and Copra from the Pacific is striking. For example, the average FFA for Philippine Copra in 1962 was reported as 5% oleic, as compared with 2% oleic for Pacific Copra. There have been complaints too, especially from Germany, of the poor condition of increasing numbers of consignments of Philippine Copra arriving in Europe. This is partly due, it is said, to the use of unsuitable ships. This matter, I am glad to say, was placed before the N.I.O.P. at their January Convention at Ojai.

It was accordingly gratifying to learn that the N.I.O.P. Committees have been asked to collaborate with the Philippine Copra Exporters' Association, and through our European contacts our Sub-Committees have been asked to join in drawing up a standard procedure manual, defining preparation of space, instructions to ship's company regarding ventilation, minimum amout of battening acceptable, treatment of bilges and other relevant information which would be of value to shippers, surveyors, masters and receivers.

To turn from shipment to disease, Cadang Cadang—that mysterious malady that ravages the coconut—is still being actively investigated, and recent efforts have centred on a number of weeds that grow among the coconut palms, which are considered to be possible carriers.

We wish the Philippines well in their efforts to locate and eradicate this blight which is said to have killed some 10 million of their palms since 1927.

b) *Soyabeans.* We are glad to know, and this I confirmed during my visit to Minneapolis, that a constant guard against crotalaria is kept by U.S. government officials. We are still finding examples of these seeds in shipments of U.S. beans to Europe, although not in excess of the official limit for No. 2 beans of two seeds of crotalaria per 1000 g of grain.

I know personally of a recent shipment from Norfolk, Va., to a U.K. port where one crotalaria seed per 3½ k was found. After elaborate screening and separate storage of this shipment it was estimated that 10 seeds were present per ton of beans. This is, of course, well below the limit laid down by the U.S. Grain Standards Act; yet, it is difficult to determine actual concentration, and pockets may contain much higher percentages.

It cannot be too strongly emphasised to all concerned in shipment of U.S. beans that such is the menace of crotalaria to the crusher he will go to considerable expense to protect his customers from it, even if only *one* seed is discovered in a sample. This criticism should, of course, be taken within the context of many thousands of tons of good quality beans having been received from the U.S. in Europe during the year.

c) *Sudanese Cottonseed.* Large quantities of old-crop cottonseed have been received this year from the Sudan in a disgraceful condition. This was due to torrential rain before shipment and was all the more unfortunate because normally crushers have a high opinion of the quality of this seed. As it is, crushers have been quite unable to supply their customers with a reasonable quality of oil from this seed. Some have lost considerable sums of money. Quite apart from the immorality of those who knowingly ship such damaged parcels, is it right, in this modern age that this seed should still be bought on the basis of a monthly standard established largely on "look and sniff" techniques?

Our Consultative Committee will be asked by the U.K. crushers in September to consider a suggestion of replacing existing contracts with one based on an FFA reciprocal clause, possibly to include oil content on a reciprocal basis, which would be satisfactory to buyers and sellers alike.

d) *Groundnuts.* I referred last year to toxicity in groundnuts and groundnut meal. The toxin, now referred to as Aflatoxin, has been identified, and laboratory methods of estimation have been considerably improved. Research into the nature of the toxin and means of preventing its growth is being actively pursued by government bodies in Europe, and in producing countries. In Britain, government departments are making a survey into the incidents of positively reactive meals which have occurred in the U.K. during the last 12 months.

Conclusion

For the future, much depends for all of us on the extent and the speed with which living standards are raised everywhere. In Europe we can note in several countries a surge upwards, even though standards have been rising for many years. Outside Europe, the scope is immense. We are all aware of this, but few people, apart from the U.S.A. do anything very much about it.

It is the bane of the lives of so many of us engaged in manufacturing industry that we cannot go ahead as fast as we would like to advance technologically because of resistance from labour. The Netherlands are the leaders in Europe in the E.E.C. plan for the harmonising of wages and working conditions within the Six countries.

All of us, who are humanitarians at heart, must wish for the raising of standards of life everywhere in the world. The benefit of a Congress such as this lies largely in forging bonds between member countries scattered over the globe. As countries become nations they seek advice and support from the older established nations. How many of you know that there are already 33 independent nations on the Continent of Africa? From areas such as this our membership is bound to grow. As the years go by, greater tolerance of one nation for another, of one skin for another, of one civilisation for another civilisation must surely reveal itself. Let us hope that this Congress may be full of healthy criticism, but free from all rancour. May we progress together towards a closer understanding of our mutual problems.

Smalley Check . . .

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in the determination of a result closest to the "true" or average determination of all the laboratories.

4) Average deviations for the same characteristic differ among different samples. Greater proficiency is required by the individual laboratory where the average deviation is large, and this is reflected by a higher score for the same unit difference from the sample mean. Shown in Table II for samples 4 and 5, where differences are both 0.1%, sample 4 has an average deviation higher than sample number 5 and also the higher score.
5) The probability of tie scores is extremely remote for any characteristic or sample, as well as for the average of all characteristics and samples.
6) Annual scores of each laboratory and for all the laboratories as a group can be compared to other annual scores to determine changes in proficiency.
7) As more precise work is done by all the laboratories as a group, with consequent lower average deviations, more accurate work will be required for any laboratory to maintain a high score.