QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES
DIVISION OF PLANT INDUSTRY BULLETIN No. 407

A VISUAL APPRAISAL METHOD FOR THE ESTIMATION OF BOTANICAL COMPOSITION IN A DENSE SWARD

By J. A. GARTNER, B.AGR.SC.

SUMMARY

At the commencement of a nitrogen fertilizer trial on a grass sward consisting of kikuyu grass, paspalum and carpet grass, two intensities of a visual appraisal method were compared with the point quadrat method for the estimation of changes in botanical composition.

For speed and ease the visual appraisal method was far superior to the point quadrat method. There was no difference in accuracy between the two intensities of visual appraisal, and the method was as accurate as the point quadrat method when standard errors were expressed as a percentage of the grand mean.

The lower intensity of visual appraisal was chosen for use.

I. INTRODUCTION

In October 1961, a nitrogen fertilizer experiment was commenced at Minbun on the Atherton Tableland, to study the effect of different application rates of urea on a dense sward of kikuyu grass (*Pennisetum clandestinum* Hochst.) and paspalum (*Paspalum dilatatum* Poir.) which had been invaded by narrow-leaf carpet grass (*Axonopus affinis* Chase). Criteria of study were to be dry-matter yield, nitrogen recovery and changes in botanical composition.

In order to choose a suitable method for quantifying changes in botanical composition, two intensities of a visual appraisal method were compared with the point quadrat method of Levy and Madden (1933).

The point quadrat method was chosen as the standard for comparison, since, apart from the absolute dry-weight analysis for yield of the component species, it is regarded as the most precise method available for the determination of the rooted components in a dense sward. Both basal area estimate and weight analysis, though accurate in the measurement of small differences, are time-consuming and exhausting. Therefore, it was felt that if speed and ease could

be increased by another method without too great a loss in the accuracy provided by these methods, this would be satisfactory, since big differences were needed if the treatments were to be of any practical value.

II. EXPERIMENTAL

Plots were 40 lk x 40 lk. The five nitrogen treatments were arranged at random within each of six blocks on a flat alluvial terrace. A sprinkling of white clover occurred in some of the plots. The incidence of weeds was negligible. Both of these minor components were ignored for the purpose of method evaluation. At the commencement of the experiment the sward was trimmed to a height of 1-4 in. above ground level with an Autoscythe.

Initial appraisal revealed paspalum and carpet grass to be co-dominants in the sward. The former normally grows erect from a strong crown with a short rhizone. On this site it produced a very dense, low sward, which is typical under continuous grazing and low nitrogen status. Carpet grass is stoloniferous with weak crowns. It produces a more open sward when compared with paspalum under these conditions, although from the surface it appears to form a dense "carpet"; hence the name. Kikuyu grass, normally strongly stoloniferous and sod-forming, occurred only in small areas and appeared very unthrifty. Chippindall (1955) provides more specific information on the morphology of these species.

The point quadrat consisted of five vertical pins of 20-gauge copper wire, each 13 in. long, bent at the top and sharpened at the bottom. Pins were 4 in. apart in a frame of $\frac{3}{4}$ in. x $\frac{1}{4}$ in. strap iron mounted on legs of $\frac{1}{2}$ in. iron rod. The horizontal bars in the frame were 6 in. apart and 2 ft long. The frame was 1 ft high. When the quadrat was "placed" for calling the strikes, all bends in the pins were in line.

Four hundred points from 80 placements were recorded per plot. Placements were random on the basis of five "runs" of 16 placements, runs being approximately 3 ft apart and placements 15 in. apart. The analysis was made over the datum area of 30 lk x 30 lk.

Because of the morphological differences between the three species, a "hit" was defined as a strike on the crown; in the stoloniferous species, the stolon had to be rooted ahead of the strike. Botanical composition was derived from such basal area data.

The criterion of analysis in the visual appraisal method was an eye estimate of foliage cover at a particular time of the year. The whole of the datum area was estimated by the use of a 2-lk square net, made of $\frac{1}{4}$ in. cotton rope (Figure 1). The timber supports were 12-ft lengths of 2 in. x 1 in. timber jointed by back-flaps for folding to facilitate transport and movement from plot to plot. A red dye was used to mark off the datum area of 30 lk x 30 lk. This was then marked into 10 lk x 10 lk divisions listed A to I. Six-inch steel pegs were used to hold the net in a firm position.

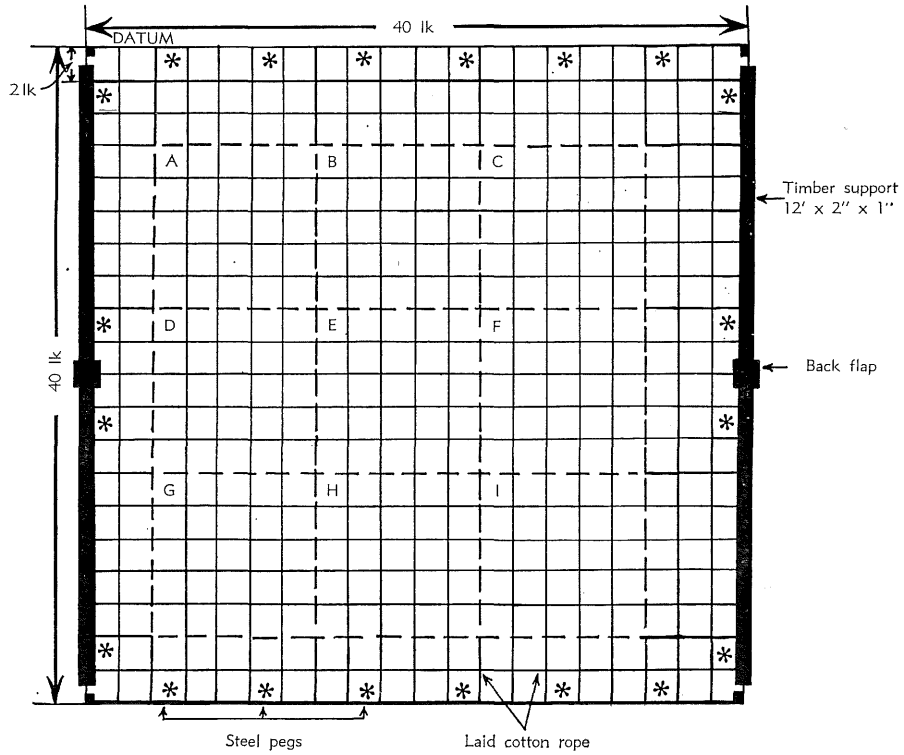

Fig. 1.—Visual appraisal net—9 "call" areas, each 100 sq lk; or 225 "call" areas, each 4 sq lk.

The method was tested at two intensities. This involved 9 estimations (10 lk x 10 lk divisions) and 225 estimations (2 lk x 2 lk divisions) per plot. Each division whether large or small was allotted 10 points and these were divided between paspalum, carpet grass and kikuyu grass—e.g. P–C–K; 7–2–1—and recorded. A recording sheet for 9 estimations is illustrated in Table 1.

TABLE 1

RECORDING SHEET FOR THE LOW-INTENSITY VISUAL APPRAISAL METHOD

Plot No.	Species	Sub-plot Symbol									Totals	Botanical Composition (%)
		A	B	C	D	E	F	G	H	I		
II (iii)	P	1	2	3	4	3	3	4	3	2	25	27·8
	C	7	6	5	5	2	3	4	4	6	42	46·7
	K	2	2	2	1	5	4	2	3	2	23	25·5

Visual appraisal was begun in the bottom left-hand corner of the net. The observer moved from G to I, D to F and A to C. This was necessary to prevent calling grass which had been trampled. Two persons were used in both methods, one as "observer" and the other as "recorder".

The nitrogen treatments caused changes in species composition. These were recorded by the low-intensity visual appraisal method in 1962 and 1964 by the author and in 1963 by a different observer.

III. RESULTS

Convenience.—The point quadrat method was tedious, particularly where paspalum was very dense. The time taken to do individual plots ranged from 35 to 55 min. It is considered that no more than six plots should be completed in a day, otherwise fatigue would appreciably reduce observer accuracy.

Subsequent use of the low-intensity visual appraisal method (9 estimations) revealed that plots could be observed in 10-15 min. Five minutes were required to relocate the net. The 30 plots involved could be completed quite comfortably in a day and a half—i.e. 20 plots during the first day and 10 plots on the following morning.

Divisions in which one or two species were each growing well were relatively easy to call with the visual method. However, when all three species were present some difficulty was experienced in allocation of points. In addition, the close mingling of carpet grass and paspalum in a short, dense sward made assessment difficult, especially when temporary wilting occurred; this is normal in early summer on the Tableland.

Accuracy.—Table 2 shows that the standard errors for all methods, when expressed as percentages of the grand mean, are high and of the same order within species. Such high variability appears to be inherent in the species distribution over the experimental area, since increasing the intensity of visual appraisal did not reduce error. The range in size of errors indicated that paspalum was distributed more evenly than kikuyu grass, which occurred irregularly in small patches. Carpet grass occupied an intermediate position, being less regular than paspalum but occurring in much larger areas than kikuyu grass.

TABLE 2

STANDARD ERRORS PER PLOT EXPRESSED AS PERCENTAGES OF THE GRAND MEAN FROM THE ANALYSIS OF VARIANCE FOR EACH METHOD

Method	Kikuyu Grass		Paspalum		Carpet Grass	
	S.E.	% G.M.	S.E.	% G.M.	S.E.	% G.M.
Visual appraisal:						
9 calls ..	16·5	102	6·8	16	17·8	42
225 calls ..	16·6	97	7·7	20	19·2	44
Point quadrat:						
Basal area ..	2·7	91	4·9	31	4·5	44

Reproducibility.—In subsequent years, standard errors for low-intensity visual appraisal remained relatively constant. For the three grasses over three seasons they varied between 9·7 and 20·8. This suggests that between-season variability by the same observer and between-observer variability for this method may be low.

When the standard errors for this period are expressed as percentages of the grand mean, variation ranged from 38 to 63%. The narrowing of this range in comparison with the initial estimation is indicative of a more regular distribution of the species in the sward, particularly with regard to kikuyu grass.

Validity.—The very close examination of the sward demanded by the point quadrat method raised the question of the validity of comparing foliage cover derived from basal area data with that estimated subjectively by visual appraisal.

The number of old paspalum crowns with relatively little shoot recorded by the point quadrat method among the carpet grass was striking. This led to the assumption that more paspalum existed in the sward with growth potential than would be revealed by a foliage cover estimate. Similarly, the chances of the point striking species with weak crowns and/or stolons appeared less than with large-crowned species such as paspalum. Therefore, one would expect the subjective estimate of carpet grass and kikuyu grass to be greater than the derived estimate. In Table 3 these observations are confirmed by a positive mean difference of 13% for paspalum and negative differences of 7 and 5% for carpet grass and kikuyu grass.

TABLE 3

PERCENTAGE BASAL AREA OF EACH SPECIES AS ESTIMATED BY THE POINT QUADRAT METHOD WITH THE DERIVED FOLIAGE COVER IN COMPARISON WITH THAT ESTIMATED BY LOW-INTENSITY VISUAL APPRAISAL

Treatment No.	Basal Area Estimate (%) by Point Quadrat			Derived Foliage Cover (%) from Basal Area Data			Estimated Foliage Cover (%) by Low-intensity Visual Appraisal		
	Kikuyu Grass	Paspalum	Carpet Grass	Kikuyu Grass	Paspalum	Carpet Grass	Kikuyu Grass	Paspalum	Carpet Grass
1	2	15	12	7	50	43	10	34	57
2	4	14	9	16	50	35	24	36	40
3	2	16	11	7	54	39	14	40	46
4	3	18	10	9	58	33	15	48	37
5	4	17	9	14	56	30	17	49	34
Mean ..	3	16	10	11	54	36	16	41	43
s.e. ..	± 1·1	± 2·0	± 1·9				± 6·7	± 2·8	± 7·2
L.S.D. 5%	N.S.	N.S.	N.S.				N.S.	8	N.S.
L.S.D. 1%								11	

Thus the different morphology of the individual species in the vegetation type under study provided a source of error in the comparison of the different attributes measured by the two methods.

IV. DISCUSSION

It is suggested that the low-intensity visual appraisal method adequately described botanical composition at any point in time and was capable of quantifying the population dynamics observable over the 3-year period of the experiment. The time and effort involved in doing this was far less than that required by the point quadrat method. However, the method needs to be tested in other dense swards of different grass species. It is also intended to examine its use in grass-legume mixtures.

It is desirable to test different observers at the one time and the same observers at different times to obtain a better measure of the reproducibility of the observations under this method.

The use of data derived from basal area as the "absolute standard" of comparison for a different attribute is not satisfactory when one considers the effect of different basal morphology on the results obtained. In future work it would be preferable to compare similar attributes: in this case, foliage cover measured directly either by the point quadrat method or by weight analysis.

Overall, the method is particularly adapted to small-plot experiments where a quick and easy estimate of botanical composition is desired. Plot sizes in such work seldom exceed those used in this experiment. Any accuracy lost by subjective appraisal is compensated for by taking a much larger sample.

V. ACKNOWLEDGEMENTS

Thanks are due to Messrs G. W. Wilkinson and W. J. McDonald for field assistance, and the Biometrics Branch, Queensland Department of Primary Industries, for statistical analyses.

REFERENCES

CHIPPENDALE, LUCY K. A. (1955).—"Grasses and Pastures of South Africa, Part 1". (Central News Agency: Johannesburg).

LEVY, E. B., and MADDEN, E. A. (1933)—*N.Z. Jl Agric.* 46:267-79.

(Received for publication November 14, 1966)

The author is an officer of the Agriculture Branch, Division of Plant Industry, Department of Primary Industries, and is stationed at Atherton.