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SOME EFFECTS OF NITROGEN ON SEED PRODUCTION OF SETARIA ANCEPS cv. NANDI

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SUMMARY

Nitrogen applied to an established stand of cv. Nandi resulted in a large increase in seed yield and germination percentage. An application rate of 224 kg ha^{-1} was no more effective than 112 kg ha^{-1} in increasing yield but did further improve germination percentage considerably. There was no carry-over effect on the second crop of nitrogen applied early in the life of the first. Splitting the nitrogen application had no effect on the first crop.

I. INTRODUCTION

The use of nitrogen fertilizer on tropical grass seed crops is standard practice whenever it is economically warranted and the response to nitrogen has been experimentally documented in a number of situations, both with other species (for example, Grof 1969; Chadhokar and Humphreys 1973) and specifically with *Setaria anceps* (Hacker and Jones 1971; Bahnisch 1975; Loch pers. comm.) There are, however, some gaps in the knowledge. There is a general belief that there is no carry-over effect on a second crop from nitrogen applied to a first crop, but this has not been documented. As well, the literature records inconsistent effects of nitrogen on seed quality (see Humphreys 1974). The role of potassium fertilizer in the Near North Coast area of southern Queensland in seed production is also unknown.

This note records the effects of nitrogen (N) and potassium (K) applied each at three rates on seed yield and quality of an established stand of Nandi setaria grown in a field situation on a sandy loam podzolic soil at Coolum in south eastern Queensland.

II. MATERIALS AND METHODS

Seed was sown at 1 kg ha^{-1} with a basal fertilizer dressing of 56 kg ha^{-1} of N as urea and 22 kg ha^{-1} of P as superphosphate in February 1968. A 3 x 3 + 1 factorial array of fertilizer treatments in a randomized block design with three replications and individual plot areas of 13·2 m^2 was imposed on the established stand on 18 August, 1969, at which time a further basal dressing of 67 kg ha^{-1} of P was applied. The factorial treatments were nil, 112 and 224 kg ha^{-1} of N as urea and nil, 56 and 112 kg ha^{-1} of K as muriate. The additional treatment was 112 kg ha^{-1} of N split over three applications—56 kg ha^{-1} on 18 August, 28 kg ha^{-1} at first head emergence 18 days later, and 28 kg ha^{-1} on 3 December immediately after the first crop was harvested.

The first crop was harvested from $5 \cdot 5$ m^2 areas in the centre of each plot on 2 December. Seed heads with 20 to 30 cm of stalk were cut, placed in hessian bags, sweated in a stack for 4 days and then hand threshed. The seed so obtained was sun dried for 2 days, screened and weighed for calculation of harvest seed yields. Purity analyses and germination tests were performed 6 weeks later. Inert matter of the purity analysis consisted wholly of spikelets containing no caryopsis.

The whole area was mown at 10 cm immediately after harvest of the first crop and the trash removed. A second harvest was taken from the whole area on 10 March 1970 in the manner of the first. This seed was not tested for purity or germination.

Good weather with 1 150 mm rainfall evenly distributed over the whole period of the experiment gave full opportunity for the expression of treatment differences. Some seed loss was caused by wind and rain before harvest of the first crop—a normal occurrence.

III. RESULTS

Potassium

Neither main effects of potassium levels nor interactions with nitrogen were detected. Accordingly, the results referring to potassium are omitted.

Nitrogen

The results (table 1) raise four points of interest—

1. The first crop responded dramatically to applied nitrogen, regardless of quantity, in terms of both harvest seed yield and pure seed yield.
2. There was little or no carry-over effect on the second crop of nitrogen applied early in the life of the first.
3. There was apparently no advantage in splitting the nitrogen application, at least to the first crop.
4. Although there was no gain in pure seed yield beyond the lowest level of applied nitrogen, the yield of germinable seed was substantially greater at 224 kg ha^{-1} than at 112, owing to a much higher germination percentage.

IV. DISCUSSION

The results of this experiment provide some indication of the magnitude of the response in the field situation, and give clear confirmation of the general belief that there is no carry-over effect on a second crop of nitrogen applied to a first. The greater yield of the second crop from the plots that received the split application was most likely due solely to the 28 kg ha^{-1} applied after harvest of the first crop.

The absence of an effect of splitting the nitrogen application on the yield of the first crop accords with the general belief that only on very light soils does the seed crop benefit from nitrogen applied at an advanced stage of development (Humphreys 1974).

The increase in germination percentage with increasing nitrogen application up to the highest rate is at the same time the most interesting and the most puzzling result of this experiment. Although it does little to clarify the inconsistencies in

TABLE 1

EFFECTS OF NITROGEN ON YIELD OF HARVEST SEED, PURE SEED, AND GERMINATION PERCENTAGE OF PURE SEED

Crop	First Harvest					Second Harvest				
Nitrogen treatment (kg ha^{-1}) ..	0	112	224	112 (split)	Standard Deviation	0	112	224	112 (split)	Standard Deviation
Harvest seed yield (kg ha^{-1}) ..	44xyz†	216x	223y	209z	51	28	27	38	51	12
Pure seed yield (kg ha^{-1}) ..	24xyz	137x	131y	132z	39					
Germination (%)										
*Transformed	0·391x	0·495a	0·651ax	0·572	0·153					
Detransformed	15	23	37	29						

* Inverse sine transformation.

† Means followed by the same letter are significantly different—a denotes $P < 0{\cdot}05$; x, y, z denotes $P < 0{\cdot}01$.

the literature (Humphreys 1974), some possible explanations exist. Most effects of nitrogen on seed quality are obviously secondary—consequences of the usual primary effect of increasing tiller density.

The present situation is probably no exception. Although differences in germinability at 6 weeks after harvest could result from differences in dormancy patterns, they most likely reflect true differences in viability. The post-harvest handling of each seed lot was identical and it is unlikely that these differences developed after harvest due to differing rates of maturation of dormant seed.

A major cause of variation in grass seed quality is variation in the average state of maturity reached by a population of spikelets with the amount of nitrogen applied, and one characteristic of a lodged head is improved seed retention. Improved retention could well lead to a shift in the proportion of mature to immature seed available for harvest, and thus to the result recorded here.

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BAHNISCH, L. M. (1975).—Effect of nitrogen supply, defoliation and density on seed production of *Setaria anceps*. Ph. D. Thesis, Univ. Qd.

CHADHOKAR, P. A., and HUMPHREYS, L. R. (1973).—Influence of time and level of urea application on seed production of *Paspalum plicatulum* at Mt. Cotton, south-eastern Queensland. *Aust. J. exp. Agric. Anim. Husb.* 13:275.

GROF, B. (1969).—Viability of para grass (*Brachiaria decumbens*) seed and the effect of fertilizer nitrogen on seed yield. *Qd. J. agric. Anim. Sci.* 26:271.

HACKER, J. B., and JONES, R. J. (1971).—The effect of nitrogen fertilizer and row spacing on seed production in *Setaria sphacelata*. *Trop. Grasslds* 5:61.

HUMPHREYS, L. R. (1974).—'Tropical Pasture Seed Production' p. 48. F.A.O., Rome.

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