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SHORT COMMUNICATION (I)

# The influence of Giberellic acid on the growth of *Panicum maximum* Jacq. grown under two levels of Nitrogen


## RINGKASAN

*Satu percubaan telah dijalankan untuk memerhati pengaruh tiga paras (0, 50 dan 100 bahagian sejuta) asid giberelik (GA) dan dua paras (200 dan 400 kg ha$^{-1}$) baja Nitrogen (N) ke atas hasil dan pengeluaran anak rumput Guinea* (Panicum maximum) *di dalam keadaan tropika selama tiga kali pemotongan.*

*Keputusan yang telah didapati ialah hasil dan pengeluaran anak bertambah dengan bertambahnya N manakala GA tidak mempengaruhi hasil/pokok dan mengurangkan, dengan bererti, bilangan anak/pokok menyebabkan hasil/anak bertambah bagi pokok yang dirawatkan dengan GA.*

*Percubaan oleh Whitney* et al *(1973) menunjukkan bahawa GA boleh digunakan untuk menambahkan hasil herba bagi* Digitaria decumbens *dan* Pennisetum clandestinum *jika rawatan dibuat dimusim sejuk; tetapi pengaruh GA ke atas pengeluaran herba tidak ketara apabila rawatan dibuat di dalam keadaan tropika seperti di Cuba (Herrera dan Suarez, 1975) dan jua seperti di dalam percubaan ini.*

*Adalah didapati bahawa pokok yang dirawatkan dengan GA adalah lebih tinggi dan aturan daun dibatangnya lebih jarak membolehkan lebih banyak cahaya menembusi rumpun rumput. Oleh itu adalah dicadangkan di sini bahawa pokok yang dirawatkan dengan GA boleh ditanam dengan lebih rapat untuk menambahkan hasil herba/yunit kawasan.*


## INTRODUCTION

It has been reported that when the grass plant is treated with giberellic acid (GA) its tillering is reduced and the plant becomes more erect and stemmy (Arnold *et al,* 1967; Lester *et al,* 1972; Stobbs, 1973). Herbage drymatter yields of some tropical grasses (*Digitaria decumbens* and *Pennisetum clandestinum*) treated with GA were higher than the control when GA was applied in the cool season (Whitney *et al,* 1973). Under the tropical conditions of Cuba, however, Herrera and Suarez (1975) observed that herbage drymatter yields of *Cynodon dactylon, Pennisetum purpureum* and *D. decumbens* were not significantly affected by GA applications. Management and environmental conditions would thus seen to be important in determining the effect of GA on the growth of the grass plant.

The following investigation is aimed at observing the effects of three different levels of GA and two levels of Nitrogen on the yield and tillering in a widely grown tropical forage species, *Panicum maximum,* under Malaysian conditions.

## MATERIALS AND METHOD

*P. Maximum* grown as single plants in 25 cm diameter pots in the open in the Universiti Pertanian Malaysia Campus (mean maximum daily temperature of 32°C and mean minimum daily temperature of 22°C with seasonal variation not exceeding 2°C) were fertilized with a basal phosphate ($NaH_2PO_4$) and potassium (KCl) at 40 and 50 kg ha$^{-1}$ respectively. Two levels of Nitrogen $(NH_4)_2SO_4$) were applied at sowing and after each cut to effect an annual rate of 200 and 400 kg N ha$^{-1}$. After five weeks establishment, all the plants were cut at 8 cm above soil level and sprayed with 20 ml of giberellic acid (GA) at 0, 50 and 100 ppm. After five weeks of regrowth, the first harvest ($H_1$) was carried out to obtain the herbage fraction above the cutting height. After $H_1$ the plants were similarly treated and harvested at five week intervals at the second and third harvests ($H_2$ and $H_3$). Tillers were counted at one week after $H_1$ and $H_2$. The experiment was laid out in the form of a randomised complete block design comprising 2 N levels x 3 GA levels x 8 blocks.

## RESULTS AND DISCUSSION

*Tiller production*

It was observed that *P. maximum* had the capacity to regrow after cutting, confirming its suitability as a forage species. The total number of regrowing tillers at one week after $H_1$ was significantly higher ($P < 0.05$) under $N_2$ and $N_1$ (Table 1). At one week after $H_2$, the regrowing tillers were classified under two categories: (i) newly produced tillers, as characterised by their pointed leaf tips and (ii) extending tillers, as characterised by their cut leaf tips. Under both categories tiller number was again higher under $N_2$ than $N_1$ (Table 2). Increased N applications thus increased both the production of new tillers and the number of existing tillers that can regrow after each cut.

TABLE 1

Tiller number per pot at one week after harvest 1

| Nitrogen levels | Giberellic acid ppm | | | N mean |
|---|---|---|---|---|
| | 0 | 50 | 100 | |
| $N_1$ | 27.0 | 23.0 | 21.0 | 23.7 |
| $N_2$ | 33.1 | 27.5 | 27.5 | 29.4 |
| GA means | 30.0 | 25.3 | 24.3 | L.S.D. = 4.1 |

TABLE 2

Number of new and extending tillers at one week after harvest 2

a) New tillers

| Nitrogen levels | Giberellic acid ppm | | | N means |
|---|---|---|---|---|
| | 0 | 50 | 100 | |
| $N_1$ | 9.1 | 5.4 | 3.3 | 5.9 |
| $N_2$ | 13.5 | 8.9 | 8.4 | 10.3 |
| GA means | 11.3 | 7.2 | 5.9 | L.S.D.=3.7 |

b) Extending tillers

| | | | | |
|---|---|---|---|---|
| $N_1$ | 18.1 | 17.2 | 15.0 | 16.8 |
| $N_2$ | 23.5 | 18.8 | 20.4 | 20.9 |
| GA means | 20.8 | 18.5 | 17.7 | L.S.D.=2.3 |

The effect of GA on regrowing tillers was, on the other hand, opposite to the effect of N applications. Tiller number at one week after $H_1$ (Table 1) was substantially reduced ($P < 0.001$) in GA treated plants. The number of extending and new tillers after $H_2$ (Table 2) were similarly reduced ($P < 0.05$). GA thus inhibited tillering; Lester *et al* (1972) attributed this to GA induced apical dominance.

*Herbage drymatter production*

Herbage drymatter production at all the three harvests were significantly higher ($P < 0.05$) under $N_2$ than $N_1$ (Table 3). Increasing herbage yield with increased N applications has been established by a number of workers (Langer, 1966; Whitehead, 1970; Olsen, 1972).

The effect of GA on herbage drymatter production, at the three harvests, was not significant (Table 3). The ineffectiveness of GA in increasing herbage yield in the tropics for *C. dactylon, D. decumbens* and *P. purpureum* was similarly observed by Herrera and Suarez (1975) in Cuba. In the cool seasons, however, application of GA stimulated increased herbage drymatter production (Lester *et al,* 1972; Stobbs, 1973). Whitney (1976) observed that the effect of GA in increasing herbage drymatter yield was obvious only when soil temperatures were below 19°C. Karbassi *et al* (1971) showed that starch degrading activities in the plant which promote growth were only reactivated by GA when growing temperatures were below 30°C. Thus it is probable that since the plants in the present experiment were not under the influence of low temperature, there was no reduction of starch degrading activities; thus GA had little effect in stimulating further production of herbage in the treated plants.

It was observed that while herbage drymatter yield per plant was not affected by GA, tillering was decreased implying that herbage yield per tiller in GA treated plant was higher than the control. Visual observations confirmed that GA treated plants were taller with longer internodes and modified leaf distribution. If grown in a sward condition these plants would allow an increased light distribution and interception within the canopy which would enable the planting density to be increased with the subsequently higher herbage drymatter yield per unit area. Since, however, GA reduced tiller regeneration the long term consequence of repeated GA applications on sward persistency needs to be taken into account. The hypotheses

TABLE 3
Herbage dry matter yield (g) per pot at Harvest 1, 2 and 3

| Harvest and N levels | Giberellic acid ppm | | | N means |
|---|---|---|---|---|
| | 0 | 50 | 100 | |
| H1 – $N_1$ | 11.3 | 11.3 | 11.5 | 11.4 ) |
| H2 – $N_1$ | 15.1 | 14.6 | 15.7 | 15.1 ) $N_1$ = 13.8 |
| H3 – $N_1$ | 15.1 | 14.7 | 14.7 | 14.8 ) |
| H1 – $N_2$ | 15.1 | 17.9 | 17.3 | 16.8 ) |
| H2 – $N_2$ | 24.2 | 27.0 | 25.7 | 25.6 ) $N_2$ = 22.4 |
| H3 – $N_2$ | 25.6 | 25.2 | 23.9 | 24.9 ) |
| GA means | 17.7 | 18.5 | 18.2 | L.S.D. = 4.20 |

generated from this pot experiment thus need to be verified under sward conditions.

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