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GRASSLAND N FERTILIZATION IN HUMID TROPICS :

PRODUCTION, ORGANIC MATTER DECOMPOSITION AND UPTAKE

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Abstract

Under tropical humid conditions at low altitudes in La Reunion island an experiment was conducted in 1995 to examine the effects of mineral and organic N fertilisation on regrowth of *Chloris gayana* . Mineral fertilisation stimulates the production of leaves for the first 20 days of regrowth. Dry matter production was increased of 181 % with the combination of manure plus ammonium nitrate and only 147 % with ammonium nitrate alone. The soil microbial biomass activity, measured after 50 days of regrowth, was increased of 31 % by application of manure, 41 % by ammonium nitrate and 50 % by manure + ammonium nitrate. With organic fertilisation the uptake of N is more important in leaves than in stems.

Keywords : *Chloris gayana,,* mineral fertilisation, organic fertilisation, microbial biomass, regrowth

Introduction

Because of its geographical situation, near Madagascar, the french island of La Reunion is under tropical humid conditions at low altitudes. For this reason an experiment was conducted in 1995 to examine the effects of mineral and organic N fertilisation on regrowth of cut sward of *Chloris gayana* on forage production and on soil microbial biomass activity. *Chloris gayana* is a tropical forage, largely used over the tropics for cattle grazing or for hay production. In La Reunion this crop is mainly produced, under irrigation, for hay and the cost of fertilisation is of great importance.

Methods

The *Chloris gayana* sward was sown in 1990 on a sandy soil in a coastal farm (South west latitude 2 I° 30, longitude 55° 30) and used for hay production under irrigation. Mineral N fertilisation was 0 (Nil) and 150 Kg Ha in form of ammonium nitrate. Organic N fertilisation was 0 (Nil) and 105 Kg Ha in form of pig manure. A mixed fertilization of 105 Kg Ha manure plus 85 Kg Ha of NH4NO3 was also applied. Regrowing leaves were cut at 4 cm height, and sampled with 4 replicates of 0.25 m2, every 10 days until 60 days of regrowth. Plant samples were dried at 60'C and used for Kjeldahl N determination. P. K, Ca, Mg fertilisation was applied to correct soil defficiency. The soil microbial biomass activity was analysed in the form of soil microbial exoenzyme activity measured in microgrammes of phosphonitrophenol produced per hour in one gramme of dry soil.

Results and Discussion

Mineral fertilization stimulates the production of leaves for the first 20 days of regrowth ($P<0.05$). The effect of organic fertilization seems to be delayed, with more leaves produced between 50 to 60 days of regrowth as noted in Fig. 1. The combination of both (manure+ammonium nitrate) increases regrowth between 30 to 40 days. The effect of ammonium nitrate can be explained by the fact that nitrogen from mineral fertilizer was taken up by *Chloris gayana* mainly during the two first weeks of regrowth (Mandret and al., 1993 ; Leon and al., 1994) . During the first 50 days of regrowth, the production of dry matter is also increased ($P<0,05$) by the application of a combination of organic and mineral fertilizers as noted in Fig. 2 . Dry matter production was increased by 181 % with the combination of manure plus ammonium nitrate and only 147 % with ammonium nitrate alone. The difference cannot be explained by the quantity of N in excess applied in the first case (192 Kg/Ha instead of 150 Kg/Ha), because the application of manure alone increases dry matter production by 165%. To maintain a high forage production after 50 days of regrowth, the application of manure alone is sufficient enough. If mineral fertilisation alone stimulates regrowth during the first two weeks, its does not increase enough the production of dry matter. Mineral fertilisation increased the efficiency of organic fertilisation. The soil microbial biomass activity, measured after 50 days of regrowth, showed in Table 1 that exoenzymes activity was increased by 31 % with the application of manure, 41 %with ammonium nitrate and 50 % with manure + ammonium nitrate. Despite the fact that the soil microbial activity is increased by N fertilisation, the level of activity is very low and can be explained by irrigation practice. In this farm periods of drough, between periods of irrigation, are too long. In humid andosoils of La Reunion (over 1000m of altitude) the soil microbial activity is multiplied by 40 compared to coastal sandy soils. Mineralization of organic N is low under 5^0C but increased exponentially from 5 to 30^0C except when long periods of drough occur (Ruiz and al. , 1995). With organic fertilisation the uptake of N in fertilized plots is more important in leaves ($P<0.05$) than in stems compared to non-fertilized plots (Table 2).

References

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Figure 1: Ratio of leaves/stems of *Chloris gayana* from 10 to 60 days of regrowth with different fertlizers

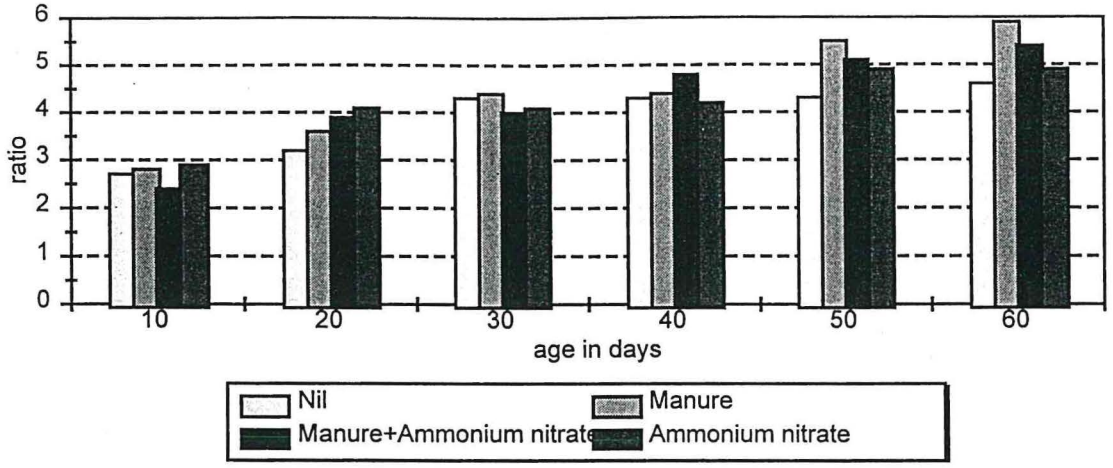

Figure 2: Production of dry matter of *Chloris gayana* from 10 to 60 days of regrowth with different fertilizers.

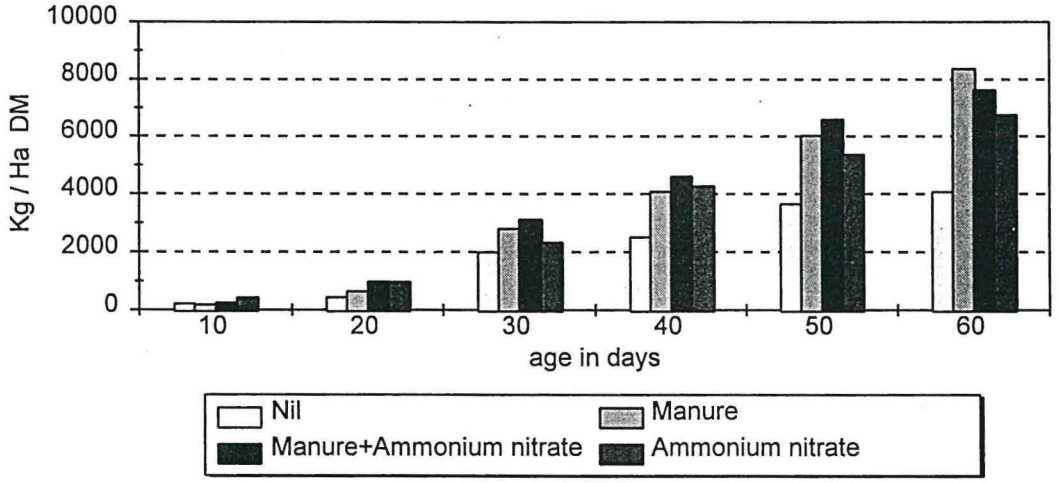

Table 1 Microgrammes of phosphonitrophenol produced per hour in one gramme of dry soil after 50 days of regrowth of *Chloris gayana* and percentage of increased activity

-	**Nil**	**manure**	**manure + ammoniumnitrate**	**ammonium nitrate**
microgrammes	48	63	72	68
%	0	31	50	41

Table 2 Partition in percentage of total N in stems and leaves of *Chloris gayana* after 30 days of regrowth

	Nil		**manure**		**manure + ammonium nitrate**		**ammonium nitrate**	
regrowth	stems	leaves	stems	leaves	stems	leaves	stems	leaves
	%	%	%	%	%	%	%	%
30 days	39	61	30	70	41	59	39	61
40 days	44	56	35	65	39	61	36	64
50 days	40	60	33	67	32	68	34	66
60 days	36	64	33	67	39	61	33	67