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EFFECTS OF NITROGEN AND DESFERAL TREATMENTS ON CROTALARIA's (Crotalaria juncea ROTH) BIOMASS PRODUCTION

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Abstract

Presently sustainable agriculture is vital to achieving food security poverty alleviation and environmental protection because land degradation and desertification has occurred in all the world over cutting across a broad spectrum of contrasts in climate, ecosystem types, land uses and socio/economic settings. For this reason improving integrated soil fertility management is appreciationed and has become a major issue of concern on the development plant nutrition and plant production agendas. On plant nutrition level mineral macronutrients so nitrogen and chelating agents of different microelements so Desferal- deferoxamin-methansulfonic are essential for plant growth and development. Crotalari juncea L. is a well-known nutrient indicator fodder and green manure crop with a high yield potential. Field experiment was carried out on a chernozem meadow soil (Kunság-region of Hungary, Kunmadaras) in partly of experiment series (6 years) in 2001. The ploughed layer of region soils contained with about 2.6-3.4% humus and 40-42% clay, had a humus stability index of 0.9-2.5 by Márton (1997), pH (H2O) of 6.5-7.7, pH (KCl) of 5.3-6.8, y1 of 6.7-13.3. The topsoil was poorly supplied with all five macronutrients (N-NO3 1 mg 100 g-1, AL-soluble P2O5 14 mg 100 g-1, AL-K2O 36 mg 100 g-1, Ca 330 mg 100 g-1, Mg 43 mg 100 g-1) and with all four micronutrients (0.5m HNO3 soluble Cu 1 mg kg-1, Zn 1 mg kg-1, Mn 9 mg kg-1, Fe 80 mg kg-1) according to soil analysis. The groundwater depth was 2-3 m. Nitrogen x Desferal (Novartis Pharma AG Basie, Switzerland, Suiza 500mg) x Genotype (Brazíl-EMBRAPA/CNPH, Brazilia-DF, India-University of Agricultural Sciences, Bangalore) x Time experiment involved 4Nx2Dx2Gx3T=48 treatments in 3 replications giving a total of 144 plots. The N levels were 0, 100, 200 and 300 kg ha-1 year-1, and desferal levels 0 and 20 kg ha-1 year-1 with a 100 kg ha-1 year-1 P2O5 and 120 kg ha-1 year-1 K2O basic fertilisation. The plot size had an area of 4x2=8 m2 with 920-920 individual plants. Experimental datas were estimated by MANOVA of SPSS. The most important results can be summarised as follows: a., As the N supplies improved the root length (cm), plant height (cm), mean scores (1-5), fresh root weight (t ha-1), green straw+leaf weight (t ha-1), total green biomass weight (t ha-1), air dry root weight (t ha-1), air dry straw+leaf weight (t ha-1), and total air dry biomass weight (t ha-1) increased with an 1.4, 1.3, 4.3, 1.3, 1.8, 1.6, 2.1, 1.9 and 2.0 times compared to the control by the start of flowering. b., As the N doses rised the root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight reaching 34.3 cm, 168.0 cm, 4.3, 14.8 t ha-1, 51.7 t ha-1, 66.5 t ha-1, 7.4 t ha-1, 16.5 t ha-1 and 23.9 t ha-1. c., About three-fourth of the total green biomass and total air dry biomass production at harvest was given by the straw+leaf yield, which ranged between 29.0-51.7 t ha-1 and 8.7-16.5 t ha-1, depending on the N-treatment applied. d., The root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight was increased in average with an 14, 15, 21, 157, 30, 63, 102, 28 and 51% by N+Desferal treatments compared to mean of N doses effects. e., By N+Desferal treatments the root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight achieved 37.0 cm, 173.3 cm, 4.3, 37.8 t ha-1, 64.4 t ha-1, 102.2 t ha-1, 13.8 t ha-1, 19.3 t ha-1 and 33.1 t ha-1. f., Approximately two-third of the total green biomass and total air dry biomass production at harvest was given by the straw+leaf yield, which ranged between 44.7-64.4 t ha-1 and 24.1-33.1 t ha-1, depending on the N+Desferal treatment rates. g. On the given soil the highest quantity of 300 kg ha-1 year-1 N mineral fertilizer + 20 kg ha-1 year-1 Desferal chelating agent seemed to give already over fertilization and lowered in its tendency mainly the total green biomass yield and verifiable the total air dry biomass yield. By

experimental results can be summarised that we was able to increase with a great rate Crotalaria juncea L. total green biomass yield and total air dry biomass yield by N and Desferal treatments. As well as so we can show and offer our results to different sustainable farming managements with nutrition system of low, mean and high input in the next future.

Keywords: nitrogen, desferal, crotalaria, soil fertility, sustainable agriculture management

Introduction

Presently sustainable agriculture is vital to achieving food security poverty alleviation and environmental protection because land degradation and desertification has occurred in all the world over cutting across a broad spectrum of contrasts in climate, ecosystem types, land uses and socio/economic settings. For this reason improving integrated soil fertility management is appreciationed and has become a major issue of concern on the development plant nutrition and plant production agendas. On plant nutrition level mineral macronutrients so nitrogen and chelating agents of different microelements so Desferal- deferoxamin-methansulfonic are essential for plant growth and development. Crotalari juncea L. is a well-known nutrient indicator fodder and green manure crop with a high yield potential.

The complexity of the desertification phenomenon has drawn our attention to categorize, inventory, monitor and repair the condition of the land (Arnalds and Archer 1999). Therefore, farmers are constantly being subjected to soil fertility changes that are beyond their control on account of factors that affect the viability and profitability their farming enterprise. They must acquire the capacity to respond to these changing situations and opportunities in order to maximise production. Grower need to be helped to develop this capability by encouraging their innovations and by involving them in a learning process in which they are exposed to new knowledge and technologies. The functioning of soils and their ability to supply nutrients, store water, release greenhouse gases, modify pollutants, resist physical degradation and produce crops within a sustainable management system.

Mineral fertilization is determined in the first place by the needs of plants for nutrients but due attention must also by given to soil process. Nitrogen is essential to the growth and reproduction of crops. It plays a major role in the development and functions of protoplasm, being an essential constituent of all proteins. Crotalaria has a high demand for nitrogen. The problem of the nitrogen nutrition in case of this plant is much more difficult than those of phosphatic or potassic nutrition because production is limited by nitrogen deficiency more often than by that of any other nutrient. The omission of no other element causes such a drastic decline in yield and growth. Nitrogen is therefore without question the most important fertilizer nutrient for this crop.

The essential micronutrients -also called trace or minor elements- or elements taken up by plants in very much smaller amounts, are iron, boron, zinc, copper, manganese, molybdenum and chlorine. Deficiencies in the supply of these elements to crops may be due to their absence or scarcity in the soil or to their being present in the soil but unavailable because of certain soil conditions -in very calcareous or in overlimed soils, in very old acidic, leached soils etc. Each of these nutrient elements has a definite key function also within the plant. Some of these functions are still imperfectly understood.

In many early studies on plant utilization of microelement chelated (for example Fe chelated) with a high stability constant in solution by various synthetic or natural chelates were assumed to be more efficient as micronutrient suppliers to plants than the uncelated micronutriens. Primary criterion for microelement complexes is a high complex stability. Various siderophores and synthetic chelates stability constants are well documented in many papers (Shenker at al. 1996). Desferal -chelating agent deferoxamin-methansulfonic- is a well know chelator with a high stability constant and micronutrient supplier potential to plant nutrition.

Sunn hemp (Crotalaria juncea L.) is one of the earliest, important and most distinctly named animal fodder and green manure plant. There is one of the most widely grown crop throughout the tropics, subtropics and temperate climate conditions. It is grown in rotation with rice, maize, tobacco, cotton, sugar cane, pineapples, coffee, orchard and in other crops. It is characterized by its rapid growth and high biomass production potential of green (60 t ha-1) and dry (20 t ha-1) material (Kiyoko 1996). As a green manure for example has been the key element in the maintenance of soil organic matter content, of soil fertility (Márton 2001). Crop is ploughed in after

2 months when the plants begin to flower as it decomposes more rapidly at this stage. The mentioned above yields wich on decomposition may add 80-100 kg ha-1 of N to the soil.

Materials and Methods

Field experiment was carried out on a chernozem meadow soil (Kunság- region of Hungary, Kunmadaras) in partly of experiment series (6 years) in 2001. The ploughed layer of region soils contained with about 2.6-3.4% humus and 40-42% clay, had a humus stability index of 0.9-2.5 by Márton (1997), pH (H2O) of 6.5-7.7, pH (KCl) of 5.3-6.8, y1 of 6.7-13.3. The topsoil was poorly supplied with all five macronutrients (N-NO3 1 mg 100 g-1, AL-soluble P2O5 14 mg 100 g-1, AL-K2O 36 mg 100 g-1, Ca 330 mg 100 g-1, Mg 43 mg 100 g-1) and with all four micronutrients (0.5m HNO3 soluble Cu 1 mg kg-1, Zn 1 mg kg-1, Mn 9 mg kg-1, Fe 80 mg kg-1) according to soil analysis. The groundwater depth was 2-3 m. Nitrogen x Desferal (Novartis Pharma AG Basie, Switzerland, Suiza 500mg) x Genotype (Brazíl-EMBRAPA/CNPH, Brazilia-DF, India-University of Agricultural Sciences, Bangalore) x Time experiment involved 4Nx2Dx2Gx3T=48 treatments in 3 replications, giving a total of 144 plots. The N levels were 0, 100, 200 and 300 kg ha-1 year-1, and desferal levels 0 and 20 kg ha-1 year-1 with a 100 kg ha-1 year-1 P2O5 and 120 kg ha-1 year-1 K2O basic fertilisation (Table 1.) in the form of 34% NH4NO3, 18% superphosphate and 60% potassium chloride. The plot size had an area of 4x2=8 m2 with 920-920 individual plants. Forecrop over 2 years was crotalaria. Plant samples were taken and measured (green and air dry matter weight) during the vegetation grown period at least 3 times (07.07.2001., 23.08.2001. and 20.10.2001.), using 5-5 plants plot-1 randomly. Experimental datas were estimated by MANOVA of SPSS. The main goal of the whole research programme was described earlier by Márton (1999). This paper reports results of Nitrogen x Desferal x Indian genotype experimental combinations at stage the start of flowering of 23.08.2001.

Results and Discussion

Improving soil fertility in all the world over farming systems has become a major issue of concern on the development plant nutrition and plant production agendas. A number of international initiatives and programmes have been established which aim to address the problem of soil fertility decline, and would imply major investment of soil researches. This research reports on the nitrogen x desferal nutrition and potential use of Crotalaria juncea L. as a nonwood source of animal fodder and green manure under temperate climate conditions to soil fertility maintenance. The most important results can be summarised as follows. As the N supplies improved the root length (cm), plant height (cm), mean scores (1-5), fresh root weight (t ha-1), green straw+leaf weight (t ha-1), total green biomass weight (t ha-1), air dry root weight (t ha-1), air dry straw+leaf weight (t ha-1), and total air dry biomass weight (t ha-1) increased 1.4, 1.3, 4.3, 1.3, 1.8, 1.6, 2.1, 1.9 and 2.0 times compared to the control (Table 2.) by the start of flowering. As the N doses rised the root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight reaching 34.3 cm, 168.0 cm, 4.3, 14.8 t ha-1, 51.7 t ha-1, 66.5 t ha-1, 7.4 t ha-1, 16.5 t ha-1 and 23.9 t ha-1. About three-fourth of the total green biomass and total air dry biomass production at harvest was given by the straw+leaf yield, which ranged between 29.0-51.7 t ha-1 and 8.7-16.5 t ha-1, depending on the N-treatment applied. The root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight was increased in average with an 14, 15, 21, 157, 30, 63, 102, 28 and 51% by N+Desferal treatments compared to mean of N doses effects. By N+Desferal treatments the root length, plant height, mean scores, fresh root weight, green straw+leaf weight, total green biomass weight, air dry root weight, air dry straw+leaf weight and total air dry biomass weight achieved 37.0 cm, 173.3 cm, 4.3, 37.8 t ha-1, 64.4 t ha-1, 102.2 t ha-1, 13.8 t ha-1, 19.3 t ha-1 and 33.1 t ha-1. Approximately two-third of the total green biomass and total air dry biomass production at harvest was given by the straw+leaf yield, which ranged between 44.7-64.4 t ha-1 and 24.1-33.1 t ha-1, depending on the N+Desferal treatment rates. On the given soil the highest quantity of 300 kg ha-1 year-1 N mineral fertilizer + 20 kg ha-1 year-1 Desferal chelating agent seemed to give already over fertilization and lowered in its tendency mainly the total green biomass yield and verifiable the total air dry biomass yield. By experimental results can be summarised that we was able to increase with a great rate Crotalaria juncea L. total green biomass yield and total air dry biomass yield by N and Desferal treatments. As well as so we can show and offer different nutrition systems -with input of low, mean, high level- to different sustainable farming managements next future.

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