SOME EFFECTS OF BORON TO THE GROWTH AND CHEMICAL COMPOSITION OF SAINFOIN (*ONOBRYCHIS VICIAEFOLIA* SCOP.)

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Nenita Fabros Juan

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ABSTRACT

Some effects of boron on the growth and chemical composition of sainfoin (*Onobrychis viciaefolia* Scop.) plants cv Fakir were evaluated in a glasshouse.

The growth and development of sainfoin plants was not affected by the different levels of boron applied but was affected by nitrogen application and inoculation due to the nodulation failure of the latter. Generally, the root showed the highest dry matter yield and the fastest relative growth rate.

Similarly, the total nonstructural carbohydrates of the sainfoin plants were not affected by the different levels of boron. Nitrogen application reduced the total nonstructural carbohydrates of the whole plant. Moreover, when 1 ppm boron was applied, both the shoot and the root yielded the highest total nonstructural carbohydrates. Likewise, root and shoot total nonstructural carbohydrates were reduced by the application of nitrogen. Roots gave a higher total nonstructural carbohydrate yield than the shoot.

Boron content of the whole sainfoin plant, the shoot and the root ranging from 0 - 55 μg/g increased in proportion with the increment of boron applied. Similar results were obtained from boron uptake of the whole plant, the shoot and the root. There was a depression of boron concentrations and boron uptake of the whole plant, the shoot and the root, when nitrogen was applied, implying a deficiency situation.

Although nonsignificant effects of boron levels were obtained from nitrogen and phosphorus concentration and uptake, respectively, of both shoot and root, application of 2 ppm boron reduced the concentration of nitrogen but not nitrogen uptake, and reduced phosphorus concentration and phosphorus uptake. Application of nitrogen increased shoot and root nitrogen contents and nitrogen uptake but decreased root and shoot phosphorus concentrations and phosphorus uptake.

It was concluded that levels of 2 ppm boron concentration were not adequate to support satisfactory growth when plants were supplied with sufficient levels of other nutrients.

Keywords: Boron, nitrogen, *Rhizobium*, total nonstructural carbohydrates (TNC)

INTRODUCTION

Sainfoin (*Onobrychis viciaefolia* Scop.), a newly reintroduced forage crop in New Zealand, has drawn considerable interest in the research field. It is thought to have a nutritional value, no bloating tendencies as a livestock feed and a potential substitute for alfalfa (*Medicago sativa* L.) (Clarke & Reid, 1974; Jones & Lyttleton, 1971; Usman *et al.*, 1968) and known to be a drought and winter hardy crop (Koch *et al.*, 1972; Spedding & Diekmahns, 1972). However, it has not been accepted agriculturally because of its excessive coarseness, poor leafiness and probable low palatability (Eslick, 1968), visual characters which can be misleading. In addition, it has been found to have poor establishment with Rhizobium infection, leading to poor nodulation, and thus to inefficient nitrogen fixation. In some cases, plants are nodulated abundantly but nodules are ineffective and are inefficient in fixing dinitrogen (Ross & Delaney, 1971; Burton & Curley, 1968; Sims *et al.*, 1968). Sainfoin, however, was reported to outyield alfalfa consistently in areas where production is limited to one cutting (Hanna & Smoliak, 1968). Likewise, it also grows better on drylands where precipitation is sufficient to grow one hay crop (Cooper, 1965). In addition, sainfoin cotyledons were found to contribute as much as 100, 54, and 18% of total seedling photosynthesis at 7, 11, and 19 days, respectively (Fransen & Cooper, 1974). Cotyledons of sainfoin, therefore, provide a substantial contribution to the nourishment of newly emerged seedlings, giving them a better establishment while the seedlings have no nodules yet to supply their nitrogen requirement.

Several legumes, especially forage species that are potentially capable of fixing dinitrogen efficiently have not been well studied. Due to the limited research that had been conducted on these forage legumes, i.e., cicer milkvetch (*Astralagus cicer* L.) and sainfoin, there is also limited knowledge on the proper management of these forage crops

(Major *et al.*, 1979). This includes water relations, temperature, light, soil and nutrient requirements and also proper cultural management practices, conditions that must be favourable for a successful plant growth and development. Likewise, the efficiency of the symbiotic relationship depends also on the host's capacity to provide its partner, i.e., *Rhizobia* the necessary energy requirement for dinitrogen fixation. Hence, a healthy growing legume plant has a greater capacity to provide the *Rhizobia* their energy requirement.

Despite the numerous disadvantages of growing sainfoin as mentioned previously, it has a greater potential as a livestock feed in the future. Research is needed to meet the need for more managerial and agronomic information on yield responses in terms of hay and total dry matter production as well as responses to symbiotic relationship.

One aspect of study which this project was designed to investigate is the role of micronutrient boron which is essential in plant growth and development, reproduction, carbohydrate metabolism, nitrogen metabolism, nodulation and nitrogen fixation.

The purpose of this study was to examine some of the effects of boron in plant growth and development. It included two components namely:

1. The effects of boron on the early growth and development of sainfoin in terms of dry matter production of both root and shoot, relative growth rate, root number, and leaf area, and
2. the effects of boron on the chemical composition of the sainfoin plant on the whole, specifically on boron concentration and uptake and total non-structural carbohydrate (TNC) content.

Analyses of both root and shoot tissues were completed to determine nitrogen and phosphorus contents.