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Evaluation of the effect of applications of Metalosate Boron and Zinc in raps (*Brassica napus L.*).

Season 2016/17

Introduction

The culture of raps (Brassica campus L.) is an important oil to level world and national. Your culture is established in areas with stations long and cold taking the skill of grow to low temperatures, that you has enabled adapt very good to the area South of Chile. By other side the pre-culture of raps inside of the rotation with wheat allows increase the performance of East last because to a decrease of the supply of inoculum of mushroom that attack the system root and to a reduction of infestations of weed grasses.

There are several factors that affect in more or minor measurement in the quality and productivity of the raps, be the more relevant: the genetic evidenced in the Properties differential which possess various varieties, weather (moisture, temperature, radiation), the conditions with (properties physical and chemical of the soils), and the management of the culture (tillage, control of weed diseases e insects, fertilization, etc.).

With connection to the fertilization of the culture of raps, one of the themes that more is discusses is the application of micronutrients, with special emphasis on the Boron (B). Several researchers have shown that the raps has a more request of B that the cereals and that reacts significantly to the deficiency of East micronutrient (Grant and Bailey, 1993). The boron play a paper key on the biosynthesis of the wall cell and in the control the permeability of the membrane, on the differentiation of fabrics, metabolism of CARB and protein, on the division and elongation cell, germination of the pollen and in the growth of the tube pollen, the that guarantees the curdles of seed in the siliques to reach a high performance of grain. Bass deficiency of boron, the feasibility of the pollen and the production of seed be reduces considerably (Nyborg and Hoyt, 1970) and the training of protein be restricted. Also plays a paper important on the transport of K + to the cell of guard for the system of control internal of balance of water.

The growth of the tube pollen be has revised recently in raps (Derksen, 1996). If well there a strong evidence of that the growth of the tip of the tube pollen is influenced by the calcium (Ca) (Cai et to the 1997); (Malho and Trewavas, 1996). The data about boron are minus convincing. Without however, there two studies that reveal the effects of the boron on the growth of the tube pollen on the style. In first place, the growth of the tube pollen in raps is saw delayed by of B (Shen et, 1994). Other effects of the bass level of B include a reduction on the germination of the grain of pollen and a reduction on the number of tubes pollen on the style (table 1).

Table 1 effect of the supply of boron on the germination of the pollen, on the growth of the tube pollen on the stigma of the raps (*Brassica napus*) and in the performance of grain.

Parameter measured	Level bass of B	Level right of B
Number of grain of pollen on the stigma	31	83
% of grain of pollen sprouts	29	82
Number of tube pollen penetrating the style	2	37
Performance of grain (g/plant)	0.5	3.0

Source: Shen et to the. (1994).

Dell et to the (1997) mentions also that the deficiency d B inhibits the elongation of the estate because to limited the elongation and division cell in the area of growth of the tips radical. This inhibition can be caused mainly by the effects adverse of the deficiency of B on the structure of the wall cell and in the elongation of the cell just split (Loomis and Durst, 1992).

Other research have notion that the B is essential for the development of both organ reproductive male and female in raps (Assad et to the.) 2002). Gupta (1993) also said that the B is a factor important on the process of fertilization of the flowers, and the plant with level poor of B can grow with normal but the performance of seed can be severely reduced.

The application of B increases the performance of grain of raps to through of a decrease of the number of dawn floral sterile and by a more development of the siliques (Porter, 1993). The application of B in raps also lets increase significantly the content of oil of the grain, especially when there an effect significant on the performance of grain (Pageau et to the 1999).

The lack of boron in contrast with other nutrient is the only deficiency that accelerate the process physiological in time of delay them. To the look all the symptoms of deficiency of B is can attribute to the proliferation uncontrolled of woven such as the rise on the division cell on the cambium without differentiation cell (Bussler, 1973) that driving to a growth abnormal on the cell and to the break of stems of raps. The internodes of the stems be atrophy and the plant acquires an appearance shrub or of rosette.

The deficiencies acute of micronutrient in crop of raps with symptoms visible are rare time on the most of the floors. Without however, in floor specific or bass certain conditions, the deficiency of micronutrient can limit considerably the production of crop and the production of seed. , The "deficiency latent" on that not there symptoms visible this widely, with performance of the plant that can decrease in a 20% or more (Alloway, 2008). The plants of raps with deficiency of boron, lose its flowers, produce little seed by silique. The siliques and seed be deform.

The application of boron leaf in conditions of availability limited can be more effective that the application of boron to the floor put that can be absorbed directly to through of the leaf and not of fixed on the soil. The time right for the nutrition leaf in raps is from the phase of elongation of stalk to the home of bloom (Varenyiova and Ducsay, 2014).

Interactions with other nutrient that influence on the availability of B and the effect of the treatments in of fertilization also be considered. Results in Australia suggest that a supply right of Zinc (Zn) help to mitigation the effects harmful of a supply bass of boron (Grewal et. 1998). The results show that the varieties of raps differ in the to the deficiency of B in relationship to the supply of Zn. to the increase the supply of Zn from levels appropriate to level of excess with a low supply of B, is get a rise in the content of B in the leaf and a more biomass and performance of seed (et, 2000). Without however, with an assumption right or excess of B, the levels over of Zn had an effect opposite, with the drop of the performance of biomass and seed. The higher yields of grain is manage when is supply properly B and Zn.

The Zinc (Zn) is move mainly by broadcasting. By the, all the factors that reduce the diffusion of Zn to the estate of the plant or the development of the system root also restrict the supply of zinc. By this reason, the risk of that the estate of the plant are level bass of zinc increases in floors compacted and in conditions of cold. Without however, only about just results experimental in crop of raps have been published. In experiments in flowerpots, the application of zinc rose the number of siliques by plant (+ 24%) in more measurement that the number of seed by silique (+ 5%) or the weight of 1000 seed (+ 11%) (Changski et to the 1991).

In experiments of field in 16 places of the main areas producing of in China, with different floor on the that the availability of Zn in the floor varied from 0.4 up 2.0 ppm, the application of 15 Kg / ha of $ZnSO_4$ rose the performance of seed average in a 13% (8-19%) (Changski et 1991). The response in performance this in function of the content of Zn available on the soil. The content of oil is rise in a 0.9% while that the content of Glucosinolates decreased 6.4 to 5.7% when be apply zinc.

The raps by other side is a culture susceptible to the stress by heat particularly for the development reproductive (Aksouh et, 2001, Morrison and Stewart, 2002). Aksouh et to the. (2001) also indicates that the susceptibility be notes even in episodes shorts of stress by heat for the development of seed and that the effects be manifest in cuts of performance and quality of the grains.

Morrison and Stewart (2002) identified 29.5 degree Celsius like temperature criticism in raps for the bloom. The plant of raps submitted to high temperature to often show an increase of the abscission of flowers, seed e even leaves, because to an increase on the concentration of acid abyssic (ABA) (Nilsen and Orcutt, 1996). Jones (1992) said that the high temperature reduce the biomass of the plant by the drop of the photosynthesis, while that also increases the transpiration and the conductance stomatal. As result is produce loss of performance in raps because mainly to the abortion of siliques.

The temperature and the deficit water are the two factors environmental more common to limit the productivity of the crop in all the world (Hall, 1992). Mendham and Salisbury (1995) reported that the effects of the stress by heat on the potential of performance of the seed of crop of Brassica depends on of the stage of development in which be produces the stress and the life of East. Hall (1992) and Young et to the. (2003) also identified the phase of bloom as the stage more can to the damage by heat probably because to the effects on the development of the pollen, the flowering and the fertilization (Async of the yarn and development of the gynoecium). Morrison and Stewart (2002) seen that the bloom of the raps is inhibits when the temperature ups by over of 27 degree Celsius, while to Polowick and Sawhney (1988) showed that the abortion of siliques and siliques sterile be produced to 32 degree Celsius. Morrison (1993) said of flowers of raps fully sterile to 27 / 17 ° C day/night . The stress by heat during the bloom of the raps can end premature the bloom, that is in the production limited of seed (Faraji et 2008).

With connection to the effect negative that cause the stress by heat and deficit water in raps there pretty information that indicates that the application leaf of B during the bloom da place to a more production of grains, the which is should to a more number of pod in the inflorescence main. The data also suggest that these effects beneficial of the application leaf of B are more marked in crop of raps exposed to stress by heat or deficit water, because to that the deficit of boron alter the structures of the walls cell phones that driving to the damage oxidative, the which is magnified in presence of stress abiotic (Kobayashi et, 2004). Some evidence show that the boron is involved on the protection of the membrane plasma of the damage oxidative caused by species reactive of oxygen (Ferrol et to the 1993 and Cakmak and Römheld, 1997). Of the same mode, be found that the B plays a role in the protection of membranes of the thylakoid membranes front to the damage oxidative (El-Shintinawy, 1999).

By other side, Bagci et, (2007) indicate that level appropriate of Zinc have shown improve the efficiency of the use of the water in plant of wheat. , Bass conditions of high temperatures, the zinc can help to provide thermotolerance to the device photosynthetic (Graham and McDonald, 2001).

Alloway (2008), indicates that the Zn play a role on the maintenance of the integrity of the membranes cell phones to through of the guidance structural of macromolecules and the maintenance of the systems of transport of ions. The Zn also be requires for the maintenance of the membranes to through of the interaction with the phospholipids and the groups sulfhydryl of the membranes of proteins. The loss of the integrity of the membranes is seen by many as the change biochemist more early caused by the deficiency of Zn. apart of your paper like component structural of the membranes, similar to the of the calcium, the zinc also play a role key on the control of the generation and detoxification of radical free of oxygen that can damage the fat of the membranes and groups sulfhydryl. The Zn is an action inhibitory on the damage of the membrane caused by stress oxidative. In the paper of the zinc on the membranes is of protect the fat of the membrane and of protein of the peroxidation caused by radicals free of oxygen the which justify your application in mix with boron for the period of bloom of the raps.

2. ***Materials and methods***

Make the test of field in raps in the town of Quino. The distribution of the plots of the test was with a design of blocks full to the gaming with 5 treatment and 4 repeats. The size of the plots was of 3.4 m of width x 30 m of long separate by 2 m between if.

The range of raps used for contrast the various treatment was var. Imageos in a floor with Stover of wheat burned.

The date of seed is held the 24 of April of the 2016 with a dose of seed of 2.5 Kg of seed / ha.

The treatment evaluated included the application leaf of Metalosate Boron and Metalosate Zinc. The times of application is can see on the table 3.

All the practices of management other for the production of the crop have made evenly to all the plots of the test (fertilization, control of weed pest and diseases, etc.).

Is recorded information of the number siliques by plant and performance grain (qqm / has of each an of the plots.

The count of siliques by plant is held to split of the count of the number of siliques of three plant taken to the gaming of every plot.

Grain performance was obtained from the harvest e of 102 m^2 of every plot. The vintage of the plots was the day 30 of January of the 2017 with a machine Harvester John Deere (image 1).

Image 1 - Plots to the time of the harvest.

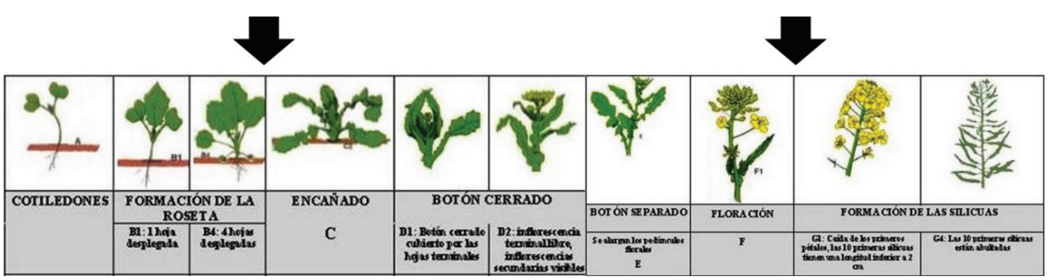
The results obtained in each of the evaluations were analyzed statistically to through of the analysis of variance (ANOVA). In those situations in that existed differences statistically significant, the averages between treatments were separate to through of the test of Tukey (p) (0.05).

In the continuation, the different treatments are presented in the table 1.

Table 1 - Treatments evaluated, dose and time of application.

Treatments	Product	Dose time of application	
		BBCH 15-16 (15/07/2016)	BBCH 62 (5/10/2016)
T1	T Control		
T2	Metalosate B	1 l / ha	---------
T3	Metalosate B	---------	1 l / ha
T4	Metalosate B Metalosate B+Metalosate Zn	1 l / ha --------	--------- 1 l/ha+1 L / ha
T5	Metalosate B+Metalosate Zn	1 l/ha+1 L / ha	1 l/ha+1 L / ha

- Applications in BBCH 15-16 in mix with Taspa (0.5 L / ha) + Lontrel (0.3 L / ha).
- Applications in state BBCH 62 in mix with Prosaro 1.3 L / ha + Pirimor (200 g /ha).



3. ***Results and discussion***

- *Number of siliques by plant and performance of grain of every treatment.*

The training of the performance of seed is the result of much process that interact and your unit of the factors environmental. For the period from the seed up to the home of the bloom, the potential of performance is sets by the number of buttons floral and index of area leaf on the home of the bloom (Mendham et to 1981; (Leterme, 1985). The pick of the rate of area leaf be reaches around of the bloom and then decreases, and the stems and pod begin to be charge of the production of assimilated. The conditions for the bloom are particularly important for the training of pod and seed (period critical).

The filled of grains be determines already be by the capacity of absorption of the destination (grains), that is governed by the number of grain and the capacity of absorption of the seed individual or by the source, is say the availability of assimilated for the filled of grain (Mendham et, 1981). Remobilization of hydrates of carbon of reserve accumulated during the phase of growth early in the roots, stems, leaf and pod, also can contribute to the filled.

In the culture of raps is very important get a rooting deep more beyond of a metro of depth of the floor for maximize the filled of grains in conditions of drought, for the which is makes need the use of controllers of growth and Applications leaf of boron. The HGCA (2006) have shown that the 50% of the crop of on the United Kingdom may have estate insufficient to a deep of 40 cm for extract all the water available.

The performance of seed is the product of the density of siliques, seed by silique and the weight half of the seeds. The growth before of the start floral influences in the number siliques by half number of sheets and in consequence, sites potential for the ramifications statutory in the underarm of the leaves (Mendham and Scott 1975). The button floral start to developed in the initiation floral to the principle of the spring (Mendham et to 1981) (Tittonel 1988). The siliques be start for the bloom, and the abortion of siliques and the reduction on the number potential of seed by silique is produce during the flowering and to a point during the phase of development of the silique. The loss of siliques and seed by silique seem to be more severe on the parts bottom of the canopy (parts grim), especially in crop dense (Mendham et, 1981). The weight average of the seed varies minus that the density of siliques and number of seed by silique (Mendham et to 1981).

To then be have the graphics 1 and 2 with the result of performance average of grain (qqm / ha) and number of siliques by plant obtained with every one of the treatment evaluated in this trial. Before of every chart is show the results of the analysis of and the result of the contrast multiple of HSD of Tukey on the case that existed differences statistically significant between the treatments.

- Analysis of the variance for the performance average of grain: p-value = 0.0000 (annex 1).

Graphic 1 - performance average of grain (qqm / ha) of every treatment.

Yield qqm (100 kg)/ha

Average with lyrics equal between the columns not differ statistically to p < 0,05 (HSD) (of Tukey).

- Analysis of the variance for the number average of siliques by plant: p-value = 0.0000 (Annex 2).

Graphic 2 - Number average of siliques by plant of every treatment.

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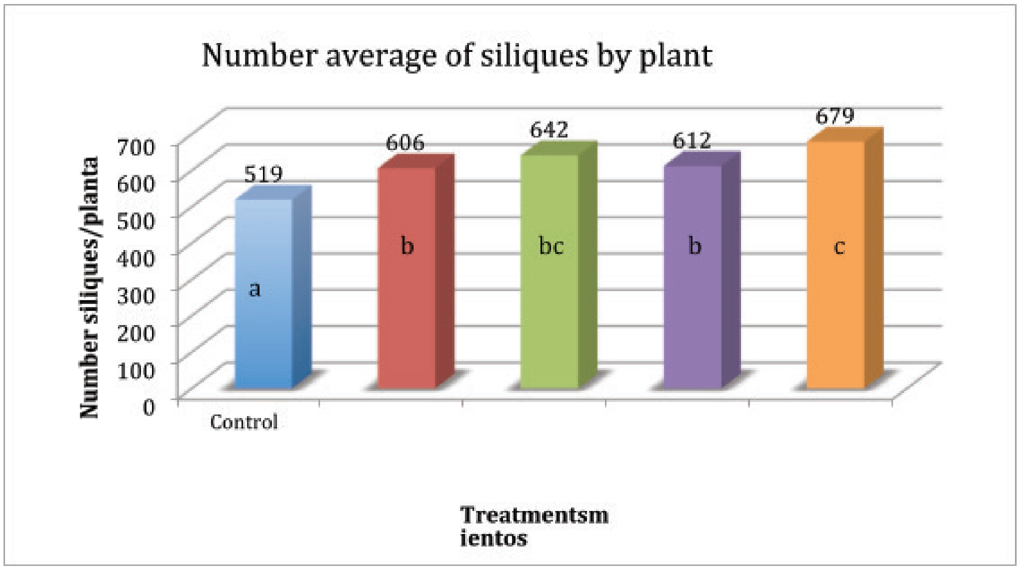

Average with lyrics equal between the columns not differ statistically to p < 0,05 (HSD) (of Tukey).

The results of performance of grain presented in the chart 1 record a response positive with differences Statistics for the treatment with Metalosate B in bloom, Metalosate B in rosette more the mix of Metalosate B and Zn in bloom, and for the treatment in mix of Metalosate B and Zn in rose and bloom. To weigh of that the treatment with Metalosate B in rose not presented differences statistics with the witness, is can see a clear trend of rise in the performance of grain (+ 1.5 qqm / ha), the which is should to a rise significant on the number of siliques by plant (graphic 2). In relationship to the test with metalosate B made on the season 2015/16 is can end that the effect in performance is more significant when the application in rosette be made in a time more close to the period of elongation of stalk and not in dates very early of development of the culture.

By other side, bass the conditions of East test is can see an effect major of rise in performance with the application of 1 L / ha of Metalosate B in bloom, getting an increase percentage of a 6% equivalent to a rise of 3.2 qqm / ha in relationship to the witness, the which is explains by a more number of grain by square meter given by a 23.7% of rise on the number of siliques by plant in relationship to the witness. By last this the group of by the treatment with Metalosate B in rose more the mix of Metalosate B and Zn in flowering and the treatment in mix of Metalosate B and Zn in rose and bloom, the which presented the over performance of grain in relationship to the witness, with increases percentage of the 8 and % 9 respectively (+ 4.2 qqm / ha and + 4.7 qqm / ha respectively), getting increase significantly the number of siliques by plant. These results are in match with the studies with applications of zinc in raps in where the number of siliques by plant is the component of the performance that more be benefits with the application of this micronutrient affecting directly on the performance of grain.

4 - Conclusions

- The results obtained show that the application of Metalosate Boron and Metalosate Zinc in raps for the state of rosette and bloom increase the number of siliques by plant, which be reflects in increases significantly the yield.

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Annexes

1 - ANOVA of performance of grain.

T AB l to toNorVto par to Corl _2 segue Curl _1

Anal l I s s of l to Var i anza

F UEN t e Sumas de cuad. Gl CGMUr ador Medi or Corci in t e - F P- Vtol orr

ENT r e gr types	62, 5	4	15, 625	16, 16	0, 0000
I nt r to gr types	14, 5	15	0, 966667		

Tot to the (Cor r .) 77, 0 19

C on t r tost e Mul t i pl e de R Angor par to Corl _2 segun Corl _1

M e t odo: 95, 0 por cint toj e HSD de Tukeand

C or l _1 Fr ec. M edi gr Groups homogeneos

t est i go	4	52, 75	X
BOR or r oset at	4	54, 25	XX
BOR or f l or	4	56, 0	XX
B r oset / BZn	4	57, 0	X
BZn r oset to / BZn	4	57, 5	X

2 - ANOVA of number of siliques.

T AB l to toNorVto par to Corl _2 segun Corl _1

Anal i i s s of l to Var i anza

F UEN t e Sumas de cuad. Gl CGMUr ador Medi or Corci in t e - F P- Vtol orr

ENT r e gr types	56183, 2	4	14045, 8	16, 12	0, 0000
I nt r to gr types	13067, 8	15	871, 183		

Tot to the (Cor r .) 69251, 0 19

C on t r tost e Mul t i pl e de R Angor par to Corl _2 segun Corl _1

M e t odo: 95, 0 por cint toj e HSD de Tukeand

C or l _1 Fr ec. M edi gr Groups homogeneos

t est i go	4	519, 0	X
BOR or r oset at	4	605, 75	X
B r oset / BZn	4	612, 0	X
BOR or f l or	4	641, 5	XX
BZn r oset to / BZn	4	679, 0	X

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