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NARROW ROW SPACING ON SOYBEAN IN THE EARLY AND CONVENTIONAL SOWING TIME IN A SUBTROPICAL REGION OF BRAZIL

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ABSTRACT - Phytotechnical positioning procedures in soybean crop must be validated in the context of the interaction between genotype, environment and management. Thus, the aim of this work was to evaluate the agronomic performance of soybean cultivars sown in different row spacing, in early (October 8th) and conventional (November 12th) sowing dates in a subtropical climate region of southern Brazil. The experimental design was in an 18 × 2 factorial scheme, with four replications. The factors were constituted by 18 soybean cultivars (with a maturity group of 5.3 to 6.4) installed with row spacing of 25 and 50 cm. Final plant population, plant height, lodging, 1000-grains weight and grain yield were evaluated. The row spacing and the cultivar used interfere in the agronomic performance of soybean, regardless of sowing date. The narrow row spacing of 25 cm increases the 1000-grains weight and soybean grain yield, regardless of cultivar and sowing date in a subtropical climate region of southern Brazil, with the most pronounced augments in the conventional sowing date. In general, the most yield cultivars were M 5947 IPRO and M 6410 IPRO.
Keywords: *Glycine max* L. Merrill, grain yield, lodging, 25-cm row spacing.

ESPAÇAMENTO NAS ENTRELINHAS REDUZIDO EM SOJA EM SEMEADURA ANTECIPADA E CONVENCIONAL EM REGIÃO SUBTROPICAL DO BRASIL

RESUMO - Os procedimentos de posicionamento fitotécnico na cultura da soja devem ser validados no contexto da interação entre genótipo, ambiente e manejo. Com isso, o objetivo do trabalho foi avaliar o desempenho agronômico de cultivares de soja semeadas em diferentes espaçamentos entrelinhas, em datas de semeadura antecipada (08 de outubro) e convencional (12 de novembro) em região de clima subtropical no sul do Brasil. O delineamento experimental foi em esquema fatorial de 18 × 2, com quatro repetições. Os fatores foram constituídos por 18 cultivares de soja (com grupo de maturidade de 5.3 a 6.4) instaladas com espaçamentos entrelinhas de 25 e 50 cm. Foram realizadas avaliações de população final de plantas, altura de planta, acamamento, massa de 1000 grãos e produtividade de grãos. O espaçamento entrelinhas e a cultivar utilizada interferem no desempenho agronômico da soja, independentemente da data de semeadura. O espaçamento reduzido de 25 cm incrementa a massa de 1000 grãos e a produtividade de grãos de soja, independentemente da cultivar e da data de semeadura em região de clima subtropical no sul do Brasil, sendo os aumentos mais pronunciados na data de semeadura convencional. De modo geral, as cultivares mais produtivas foram a M 5947 IPRO e a M 6410 IPRO.
Palavras-chave: *Glycine max* L. Merrill, produtividade de grãos, acamamento, espaçamento entrelinhas de 25 cm.

INTRODUCTION

Soybean (*Glycine max* L. Merrill) has shown significant increases in grain yield in the last decades in Brazil (CONAB, 2022). This fact is mainly due to the genetic improvement of the plants and the agronomic practices adopted. However, the genetic potential of this crop can still be further explored.

In order to increase the yield potential of soybean, studies using narrow row spacing have been carried out. This management practice alters the spatial distribution of plants in the field and, as a result, can interfere with the morphology and physiology of plants (RAHMAN et al., 2013; ZHOU et al., 2015; GARCIA et al., 2018). In this context, soybean crops sown with narrow row spacing can result in a greater speed of closing of the rows by soybean plants – contributing to weed control (BRADLEY, 2006; WELLS et al., 2014; ROSA et al., 2016), higher leaf area index (RAHMAN et al., 2013), greater number of branches per plant (ROSA et al., 2016), higher number of pods per plant (ROSA et al., 2016; GARCIA et al., 2018) and greater number of grains per plant (ROSA et al., 2016) in relation to traditional row spacing (40 to 60 cm) or wider.

Regarding yield performance, there are studies that prove that reducing the row spacing to 20 and 25 cm results in higher soybean grain yield (RAHMAN et al., 2013; CARMO et al., 2018; GARCIA et al., 2018). However, in other studies, similar or lower grain yields were found with the use of narrow row spacing (ranging from 19 to 30 cm) in relation to traditional row spacing (BALBINOT JUNIOR et al., 2015; BELL et al., 2015; MOREIRA et al., 2015). Thus, it appears that the magnitude of the difference in grain yield of plants installed in narrow or wide row spacing

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depends on the cultivar, the region of cultivation and other agronomic practices adopted, such as the sowing date (CARMO et al., 2018; THAI et al., 2019).

In southern Brazil, the period recommended for soybean sowing is relatively long; being possible, in subtropical regions with rainy winter in southern of the country, to anticipate the soybean sowing in mid-September to early October (KASTER; FARIAS, 2012; ALVARES et al., 2013). This early sowing is an agronomic strategy that can be used aiming at sowing in the second crop, as well as reducing the incidence of Asian soybean rust (TECNOLOGIAS..., 2013).

Furthermore, the choice of sowing time is a practice that influences the agronomic performance of soybean, since this determines the exposure of the plant to meteorological factors, such as variations in temperature, photoperiod and rainfall that will occur throughout the culture cycle (TECNOLOGIAS..., 2013). Thus, these meteorological variations depending on the sowing date affect the growth and development of the plant, the yield and soybean grains quality (MOURTZINIS et al., 2017; CARMO et al., 2018); in addition to being able to provide different responses to changes in the spatial arrangement of plants in the field.

It is noteworthy that studies in this area are fundamental for the adequate management of the soybean crop; however, they are still incipient, mainly due to the diversity of the country's edaphoclimatic conditions, crop management and wide range of cultivars available. Thus, the aim of this work was to evaluate the agronomic performance of soybean cultivars sown in different row spacing, in early and conventional sowing dates in a subtropical climate region of southern Brazil.

MATERIAL AND METHODS

The work was carried out at the experimental farm of the Brazilian Agricultural Research Corporation (EMBRAPA), in Ponta Grossa, Paraná state, southern Brazil, located at 25º 09' 07" south, 50º 05' 11" west and altitude of 982 m, in the 2017/18 crop season.

This site is located in the Edaphoclimatic Adaptation Region (REC) 103 for the registration of soybean cultivars, according to the official methodology of the Ministry of Agriculture, Livestock and Food Supply (MAPA) of the Brazilian government (KASTER; FARIAS, 2012). The climate of the region is classified as humid subtropical – *Cfb* (Köppen-Geiger system), with summers of mild temperatures and no defined dry season, with average temperatures in the warmest month below 22°C and in the coldest month below 18°C (ALVARES et al., 2013). In Figure 1 are presented the daily data of rainfall, maximum and minimum air temperature occurred during the conduction of the experiments.

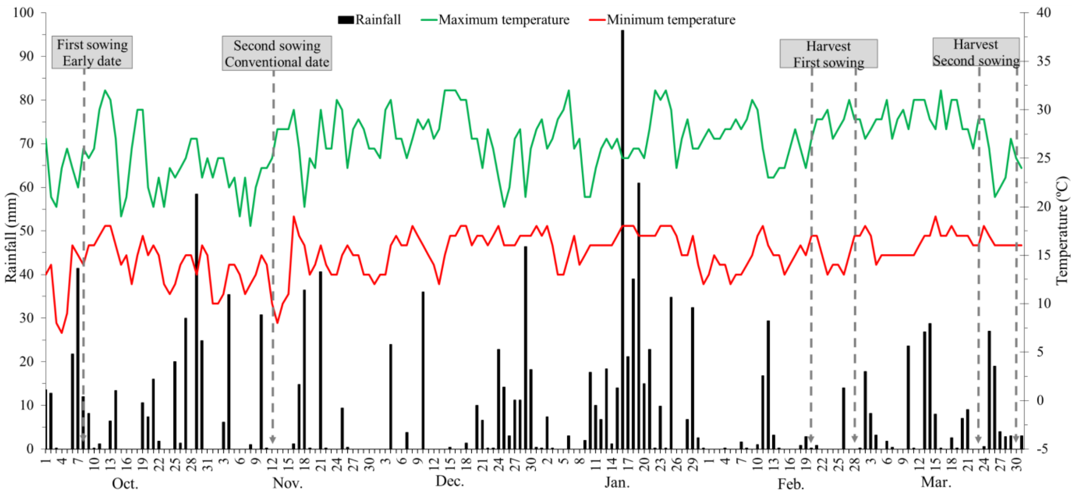

FIGURE 1 - Daily data of rainfall, maximum and minimum temperature that occurred during conduction of the experiments in Ponta Grossa, Paraná state, southern region of Brazil. Early date: October 8th; Conventional date: November 12th. Crop season: 2017/2018.

The soil was classified as a medium texture dystrophic Red Latosol (EMBRAPA, 2018). Before installing the experiments, soil sampling was carried out in the 0-20 cm depth layer to characterize chemical (EMBRAPA, 2009) and granulometric (EMBRAPA, 1997) attributes, namely: pH ($CaCl_2$): 5.78; organic matter: 39.21 g dm^{-3}; P (Mehlich^{-1}): 14.01 mg dm^{-3}; K: 0.27 $cmol_c$ dm^{-3}; Ca: 5.71 $cmol_c$ dm^{-3}; Mg: 1.93 $cmol_c$ dm^{-3}; H+Al: 3.16 $cmol_c$ dm^{-3}; CEC (pH 7.0): 11.07 $cmol_c$ dm^{-3}; base saturation: 71.45%; sand: 548 g kg^{-1}; silt: 120 g kg^{-1}; clay: 332 g kg^{-1}.

Soybean sowing dates were established as follows: (1) Early sowing date from September 20th to October 10th, as indicated by farmers and agronomists in the region; and (2) Conventional sowing date from October 21st to November 30th, according to the MAPA methodology for carrying out experiments to register soybean cultivars in REC 103 (KASTER; FARIAS, 2012). In this work, two experiments were carried out for the early and conventional sowing dates, as follows: (1) Early date: sowing on October 8th; and (2) Conventional date: sowing on November 12th.

The experiments were conducted in contiguous areas separated by a 2-m border.

The experimental design for the two sowing dates was in complete randomized blocks, in an 18 × 2 factorial scheme, with four replications. The factors consisted of 18 soybean cultivars installed with row spacing of 25 and 50 cm.

The soybean cultivars used in the experiments were P95Y52 RR [relative maturity group (MG) 5.3], DM 54i52 IPRO (MG 5.4), BMX Elite IPRO (MG 5.5), BMX Lança IPRO (MG 5.8), BRS 433 RR (MG 5.8), DM 5958 IPRO (MG 5.8), NA 5909 RR (MG 5.9), M 5917 IPRO (MG 5.9), M 5947 IPRO (MG 5.9), BRS 1007 IPRO (MG 6.0), BRS 1010 IPRO (MG 6.1), DM 61i59 IPRO (MG 6.1), BRS 413 RR (MG 6.2), BRS 1001 IPRO (MG 6.2), TMG 7062 IPRO (MG 6.2), BRS 1003 IPRO (MG 6.3), DM 6563 IPRO (MG 6.3), and M 6410 IPRO (MG 6.4). The seeds of the cultivars used were previously analyzed for germination and vigor by the tetrazolium test, according to the methodologies proposed by Brasil (2009) and França-Neto and Krzyzanowski (2018), respectively. All cultivars presented high physiological quality, with values of these variables above 90%.

The experiments were carried out on wheat straw in an area under a long-term no-tillage system (>10 years), which had been managed with soybean and corn rotation in the summer, and wheat and black oat in the winter. A seeder-fertilizer developed for agricultural experimentation in the no-tillage system was used, equipped with cutting discs for straw and precision dosers for seed and fertilizer distribution. The row spacings were 25 and 50 cm, adjusted in the same equipment. The fertilizer with P and K used in sowing was adjusted to have an equivalent dose in both spacings. The seed density was 240,000 viable seeds ha^{-1} for all treatments, which was calculated according to the germination power of the cultivars' seeds.

The experimental plots consisted of eight crop rows with 6.0 m in length. The useful area of the plots was formed by the six central rows with 5.0 m in length. Phytosanitary management (diseases, pests and weeds), seed treatment with inoculant for biological N fixation, fertilization with macro and micronutrients and all other agronomic procedures for soybean crop were carried out in accordance to Tecnologias... (2013) and Agrofit (2017).

Final plant population, plant height and lodging evaluations were carried out at the R8 soybean stage (FEHR; CAVINESS, 1977), as follows: (1) Final plant population: plant counts were carried out in 2 m contiguous rows at three random points in the plots useful area; (2) Plant height: it was determined from the sampling of 10 plants at random points in the useful area of two rows of the plots; and (3) Lodging: visual evaluations were carried out in the plots useful area with scores 1, 2, 3, 4, and 5 for 0 to 10%, 11 to 25%, 26 to 50%, 51 to 75%, and 76 to 100% of lodging plants, respectively.

Grain yield was quantified from mechanized harvesting of four lines of the plots useful area with a self-propelled harvester developed for agronomic experimentation. The grains were cleaned, weighed and their water content was determined for correction at 130 g kg^{-1}. Then, three aliquots of the grains from each plot were sampled to determine the average 1000-grains weight, with water content determined for correction at 130 g kg^{-1}.

The two experiments installed in different sowing dates were analyzed separately. The results by sowing date were submitted to tests for normality and homogeneity of variances, model additivity and independence of errors. Then, analysis of variance (ANOVA) was performed using the F test ($p \leq 0.05$) and the averages of the treatments were compared using the Tukey test ($p \leq 0.05$).

RESULTS AND DISCUSSION

Tables 1 and 2 show the summary of the analysis of variance and the results of the experimental treatments of row spacing and cultivar, for the early (October 8th) and conventional (November 12th) sowing dates. There was no significant interaction between the experimental factors for any variable studied.

For the final plant population, it was observed that the different row spacing and cultivars had no effect on this variable, in both sowing dates; that is, the final number of plants ha^{-1} was similar between all treatments. These results demonstrate that the installation procedures of the two field experiments were adequate and consistent with the experimental design, in which the same plant population was targeted in all plots, regardless of the treatment applied, which is fundamental in works of this nature.

Soybean height was affected by row spacing in the two sowing dates. In the early sowing date, greater plant height was observed at 50-cm row spacing than at 25-cm row spacing. On the other hand, in the conventional sowing date, the 25-cm row spacing provided higher soybean height in relation to the 50-cm row spacing, considering the average of all cultivars.

In the Arapoti region, Paraná state, southern Brazil, Garcia et al. (2018) evaluated the soybean cultivar BMC Apolo RR subjected to different row spacings (25, 50, 75, and 100 cm) and installed on four sowing dates in the 2012/2013 crop season. These authors also verified that the 25-cm row spacing provided greater soybean height when sown in November. These differences observed in the height of soybean plants probably occurred due to variations in meteorological conditions throughout the crop cycle as a function of different sowing dates.

In both sowing dates, the cultivar BRS 1010 IPRO presented the highest height; however, it did not differ statistically from the cultivars DM 61i59 IPRO and TMG 7062 IPRO in the two sowing dates, and also of the M 6410 IPRO when sowing was carried out in the conventional date, considering the average of the two row spacings. Such differences are due to the intrinsic characteristics of each genetic material. It is noteworthy that in all treatments, the lowest plant height was observed in the early sowing date, which is justified by the fact that the photoperiod at that date is relatively shorter in southern region of Brazil and the lower air and soil temperature at the beginning of the development cycle.

The lodging of soybean plants was not altered by the row spacing, in the two sowing dates. Soybean lodging is influenced by several factors, such as differences in susceptibility between genetic materials (BALBINOT JUNIOR, 2012; RAZA et al., 2020). In this context, for the isolated effect of cultivars, it was verified, in the early sowing date, greater soybean lodging in cultivars BRS 1001 IPRO, TMG 7062 IPRO and M 6410 IPRO. In the conventional sowing date, the highest lodging values were also observed in the cultivars BRS 1001 IPRO, TMG 7062 IPRO and M 6410 IPRO, together with the cultivar DM 6563 IPRO.

The lodging in the soybean crop can cause losses in the yield and quality of the harvested product, since in the lodging crops there are conditions that can contribute to the development of fungi and impair the sap translocation and the harvesting operation (BALBINOT JUNIOR, 2012; VILELA et al., 2020; UMBURANAS et al., 2022). However, it is noteworthy that in the present study, the lodging score was 1 for most cultivars, regardless of the sowing date. In addition, despite the lodging problem having been greater in some cultivars, it should be noted that the rates observed in this study are considered low and are agronomically acceptable (VILELA et al., 2020).

TABLE 1 - Final plant population, plant height, and lodging of soybean affected by row spacing and cultivar at sowing of October 8th (early date at sowing time) and at sowing of November 12th (conventional date at sowing time) in a subtropical region, Ponta Grossa, Paraná state, southern region of Brazil.

Treatments	Final plant population		Plant height		Lodging	
	Oct. 8th	Nov. 12th	Oct. 8th	Nov. 12th	Oct. 8th	Nov. 12th
Row spacing (cm)	Number of plants ha^{-1}		cm			
25	218649 a*	217752 a	86 b	98 a	1.1 a	1.3 a
50	222326 a	220086 a	92 a	94 b	1.2 a	1.5 a
Cultivars						
P95Y52 RR (MG 5.3)	212131 a	212269 a	65 h	76 h	1.0 b	1.0 c
DM 54i52 IPRO (MG 5.4)	224995 a	217813 a	76 gh	81 gh	1.0 b	1.0 c
BMX Elite IPRO (MG 5.5)	221309 a	219103 a	83 efgh	87 fg	1.0 b	1.0 c
BMX Lança IPRO (MG 5.8)	220076 a	220278 a	80 fgh	88 efg	1.0 b	1.0 c
BRS 433 RR (MG 5.8)	218617 a	218617 a	81 fgh	93 ef	1.0 b	1.0 c
DM 5958 IPRO (MG 5.8)	226701 a	224715 a	82 fgh	90 ef	1.0 b	1.0 c
NA 5909 RR (MG 5.9)	215806 a	212764 a	84 efg	92 ef	1.0 b	1.0 c
M 5917 IPRO (MG 5.9)	227840 a	221931 a	91 de	97 cde	1.0 b	1.0 c
M 5947 IPRO (MG 5.9)	214845 a	213712 a	94 cd	105 bc	1.0 b	1.0 c
BRS 1007 IPRO (MG 6.0)	224631 a	228908 a	94 cd	104 bcd	1.3 b	1.6 b
BRS 1010 IPRO (MG 6.1)	223308 a	223365 a	111 a	116 a	1.0 b	1.0 c
DM 61i59 IPRO (MG 6.1)	228117 a	222990 a	103 ab	112 ab	1.0 b	1.0 c
BRS 413 RR (MG 6.2)	229819 a	215327 a	89 de	89 efg	1.0 b	1.0 c
BRS 1001 IPRO (MG 6.2)	222638 a	224422 a	87 def	103 bcd	1.9 a	2.4 a
TMG 7062 IPRO (MG 6.2)	221291 a	227304 a	103 ab	113 ab	1.8 a	2.5 a
BRS 1003 IPRO (MG 6.3)	228989 a	221365 a	79 fgh	89 efg	1.0 b	1.0 c
DM 6563 IPRO (MG 6.3)	219813 a	217601 a	85 defg	94 def	1.2 b	2.1 a
M 6410 IPRO (MG 6.4)	229691 a	226051 a	100 bc	111 ab	2.0 a	2.2 a
Variation source	ANOVA (F probability)					
Row spacing (R)	0.58 ns	0.69 ns	<0.001 **	<0.001 **	0.14 ns	0.72 ns
Cultivar (C)	0.90 ns	0.92 ns	<0.001 **	<0.001 **	<0.001 **	<0.001 **
R x C	0.97 ns	0.99 ns	0.08 ns	0.38 ns	0.93 ns	0.95 ns
CV (%)	8.9	10.7	5.2	5.7	19.2	18.4

*Means followed by the same letter in a column are not significantly different by Tukey's test at $p<0.05$. * and ** significant at $p\leq0.05$ and $p\leq0.01$ by F-test, respectively. ns = not significant. CV = coefficient of variation.

The 1000-grains weight was increased by 4 and 9% when using the 25-cm row spacing in relation to the 50-cm row spacing, in the early and conventional sowing dates, respectively, considering the average of all cultivars. Similar results were observed by Garcia et al. (2018) with soybean sowing carried out on November 12th, 2013; which verified a linear reduction in the 1000-grains weight as a function of the increase in the row spacings (spacings studied: 25, 50, 75, and 100 cm).

Rosa et al. (2016) observed that narrow row spacing reduced the time of canopy closure, which contributes to reducing the incidence of weeds and can improve the capitation of sunlight and the efficiency of nutrients and water used by soybean plants. Thus, in the present study, these conditions may have contributed to the grain filling process and provided a greater 1000-grains weight.

This result is important, since the 1000-grains weight is one of the soybean yield components. Furthermore, although there are still controversies in the literature about the influence of seed size on their physiological quality and performance in the field, a recent study by Bianchi et al. (2022) demonstrated that larger seeds had superior physiological performance than smaller seeds. Thus, the results of this study may also be relevant in soybean seed production fields, when considering the same genetic material.

In the early sowing date, the amplitude in the values of 1000-grains weight between the cultivars was up to 87 g, and the cultivars P95Y52 RR and BRS 413 RR were the ones with the highest and lowest 1000-grains weight, respectively. In the conventional sowing date, the highest values for this variable were observed in cultivars P95Y52 RR and TMG 7062 IPRO and the lowest in BRS 413 RR, however the values found in cultivar BRS 413 RR did not differ statistically from M 6410 IPRO. The 1000-grains weight is an attribute that has strong genetic control, but is also affected by environmental conditions in the field, corroborating the results observed in this study (COSTA et al., 2013; LI et al., 2020).

TABLE 2 - 1000-grains weight and grain yield of soybean affected by row spacing and cultivar at sowing of October 8th (early date at sowing time) and at sowing of November 12th (conventional date at sowing time) in a subtropical region, Ponta Grossa, Paraná state, southern region of Brazil.

Treatments	1000-grains weight		Grain yield	
	Oct. 8th	Nov. 12th	Oct. 8th	Nov. 12th
Row spacing (cm)	g		kg ha^{-1}	
25	183 a*	186 a	5047 a	4890 a
50	176 b	171 b	4839 b	4323 b
Cultivars				
P95Y52 RR (MG 5.3)	230 a	214 a	3847 f	4184 c
DM 54i52 IPRO (MG 5.4)	174 efgh	168 efg	4647 de	4377 bc
BMX Elite IPRO (MG 5.5)	176 defg	169 defg	4241 ef	4161 c
BMX Lança IPRO (MG 5.8)	171 fghi	175 def	5054 abcd	4645 abc
BRS 433 RR (MG 5.8)	172 fghi	167 fg	5016 abcd	4308 bc
DM 5958 IPRO (MG 5.8)	182 def	173 def	5294 abcd	4592 abc
NA 5909 RR (MG 5.9)	171 fghi	174 def	4732 cde	4374 bc
M 5917 IPRO (MG 5.9)	183 cdef	179 cdef	4825 abcde	4600 abc
M 5947 IPRO (MG 5.9)	163 hi	175 def	5501 a	5145 a
BRS 1007 IPRO (MG 6.0)	177 defg	174 def	5309 abcd	4711 abc
BRS 1010 IPRO (MG 6.1)	185 cde	180 cde	5028 abcd	4876 ab
DM 61i59 IPRO (MG 6.1)	172 fghi	189 bc	5379 abc	4811 ab
BRS 413 RR (MG 6.2)	143 j	153 h	4948 abcd	4411 bc
BRS 1001 IPRO (MG 6.2)	195 c	198 b	4781 bcde	4556 abc
TMG 7062 IPRO (MG 6.2)	210 b	211 a	5072 abcd	4584 abc
BRS 1003 IPRO (MG 6.3)	167 ghi	171 defg	5046 abcd	4866 ab
DM 6563 IPRO (MG 6.3)	187 cd	181 cd	5080 abcd	4698 abc
M 6410 IPRO (MG 6.4)	160 i	160 gh	5457 ab	5008 a
Variation source	ANOVA (F probability)			
Row spacing (R)	<0.001 **	<0.001 **	0.009 **	<0.001 **
Cultivar (C)	<0.001 **	<0.001 **	<0.001 **	<0.001 **
R x C	0.98 ns	0.11 ns	0.82 ns	0.24 ns
CV (%)	4.2	4.6	7.1	7.8

*Means followed by the same letter in a column are not significantly different by Tukey's test at $p<0.05$. * and ** significant at $p\leq0.05$ and $p\leq0.01$ by F-test, respectively. ns = not significant. CV = coefficient of variation.

There was an isolated effect of the factors studied on grain yield, in both sowing dates. It was observed that the use of narrow row spacing provided increases in soybean grain yield in the order of 4 and 13% in relation to the use of 50-cm row spacing, in the early and conventional sowing dates, respectively.

In work conducted with different sowing dates in a no-tillage system, Garcia et al. (2018) also observed that 25-cm row spacing resulted in higher soybean grain yield compared to wider row spacing. Similarly, Zhou et al. (2015) found that grain yield was higher in row spacing of 18 and 27 cm compared to 54 cm, with yield gains ranging from 12 to 37%. Thus, it is highlighted that under the conditions in which these works were carried out and also in the present study, there was viability of soybean cultivation in narrow row spacing. In this way, Carmo et al. (2018) mention that this practice can positively assist the soybean management, favoring the sustainability of the agricultural exploitation of this plant species.

The increases in grain yield can be explained by the fact that when the soybean row spacing is reduced and the plant population is maintained, there is a more equidistant spatial distribution between the plants in the crop. This condition results in less intraspecific competition, allowing the crop to make better use of available water, light and nutrients and, as a result, can increase yield potential (ZHOU et al., 2015; ROSA et al., 2016).

Grain yield also varied according to the cultivar used. In the early sowing date, the cultivar M 5947 IPRO had higher grain yield compared to cultivars P95Y52 RR, DM 54i52 IPRO, BMX Elite IPRO, NA 5909 RR, and BRS 1001 IPRO. Still, in this condition, it was found that the less yield cultivar was P95Y52 RR, however, it did not differ statistically from the BMX Elite IPRO.

In the conventional sowing date, the cultivars M 5947 IPRO and M 6410 IPRO were the ones that reached the highest yields; however, they differed statistically only from the cultivars P95Y52 RR, DM 54i52 IPRO, BMX Elite IPRO, BRS 433 RR, NA 5909 RR, and BRS 413 RR. In addition, the lowest values of grain yield (4184 and 4161 kg ha^{-1}) were observed in cultivars P95Y52 RR and BMX Elite IPRO, respectively. It is noteworthy that the cultivars show differences in yield potential and adaptability to the environments to which they are exposed, justifying the differences observed in this work between cultivars.

From the results obtained in the present study, it appears that there are differences in plant responses to different row spacing and sowing dates in the same place, which alter morphological attributes of the soybean plant and interfere with crop yield. This highlights the importance that phytotechnical positioning procedures in soybean must consider the interactions between environments, genotypes and management, in order to positively contribute to grain yield and generate greater profitability for farmers. Thus, future research on this topic involving other cultivars and studies in other cultivation environments are suggested.

CONCLUSIONS

The row spacing and the cultivar used interfere in the agronomic performance of soybean, regardless of sowing date.

The narrow row spacing of 25 cm increases the 1000-grains weight and soybean grain yield, regardless of cultivar and sowing date in a subtropical climate region of southern Brazil, with the most pronounced augments in the conventional sowing date.

In general, the most yield cultivars were M 5947 IPRO and M 6410 IPRO.

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