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EFFECT OF SOWING DATE AND GENOTYPE ON QUALITATIVE TRAITS OF TRITICALE (X *TRITICOSECALE WITTMACK*)

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Abstract

A field experiment was carried out at the Faculty of Agriculture, University of Kirkuk, Agricultural Research and Experimental Station located in Al-Sayadah, In factorial experiment according to the split-plot design system by randomizing complete block design with three replicates. The study included three sowing dates 5- Nov., 20- Nov. and 5- Dec. and twenty genotype (RWAIDA, AMAL, MOHAND, FRAH, POLLMER, LIRON, HUI/TUB, HUI/TUB-1, CENT/1715, BW32-1-1, CMH80, CMH82, POPP-CAAL, CAAL, LIRON -1, LIRON -2, LIRON -3, LIRON -4, LIRON -5,and LIRON -6) of triticale, putting the planting dates in main plot while the genotypes were distributed in the subplots, to study the protein%, hectoliter weight kg.hl^{-1}, wet gluten%, flour strength (min.), moisture% and ash%. The result shows non-significant sowing date effects for all traits except the effect of first date on protein% and second date the effect of hectoliter weight, it reached 15.30% and 64.48kg.hectoliter^{-1} respectively. While The superiority of genotypes CAAL genotype in protein at recording 15.73%, LIRON-5 genotype in hectoliter weight recording 70.00 kg.hectoliter^{-1}, LIRON genotype recoded 21.00 in wet gluten, MOHAND genotypes in flour strength, With an average of 52.00 and CMH82 genotype in ash as 1.14%. The significant effects interactions were between dates$_*$genotypes superior the first, second and third dates with the genotypes CAAL, LIRON-5, LIRON and MOHAND in some studies traits.

Key words : Triticale, sowing date, Genotypes, Qualitative traits.

Introduction

Triticale is a hybrid resulting from a cross of rye with wheat. It is similar to wheat to significant phenotype and has a high protein percentage. However, it has lesser ability than wheat in bread making than the wheat it is less able to make bread. It is outstanding by rye characteristics such as tolerance not appropriate conditions, poor nutrition, poor soil and drought tolerance.

The importance of studying the dates of planting is due to changes in climate and weather factors from time to time, and the response of each species to these factors. The variance effects show in seed germination, the emergence of seedlings, field foundation, growth, and plant development and all bio procedure to events which is reflected to qualitative and quantitative yield traits to determine the date of appropriate (Mansour, 2018)

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Understanding how varieties performance in different environmental conditions, such as planting date to smooth field service operations in a scientific field study, as temperature and optimal light duration have a significant impact on growth and development reflected in increased productivity (Bahatta, 1992). The researchers to study plant date for Protein%, hectoliter weight kg.hl^{-1}, dry gluten% and wet gluten% by (Schwartz *et al.,* 2005), (Collier, 2012), (Ottman, 2014), (Singh, 2016) and (Prajapat *et al.,* 2018).

The economic yield for any crop is influenced by genetic factors represented by the genetic architecture for cultivated or genotype and multiple environmental factors affecting the quality of product traits (Evans *et al.,* 1975).

The varieties differed among them in protein and wet gluten percentage. Therefore triticale used to make bread after mixture with wheat flour, also found triticale verities

were less affecting to change environmental to planting season. (Erekul and Kohn, 2006).

The study of qualitative traits of the triticale crop to morphological traits other is most important as this crop is rarely used in human food due to reduced proper bread requirements (Lukaszewski, 2006), the protein percentage in triticale grain is about 11.7% Ash about 1.8% (Patterson and Aman, 1987).

The protein percentage of triticale varieties is higher than wheat, but the specifications of gluten did not reach the appropriate level for the production of a protein properties for baking with good flour, so its use was limited as feed its superior in production traits, therefore had become study qualitative important for researcher, while protein percentage of the most essential qualitative traits in triticale and other cereal crops (Oettler, 2005). Several researchers like (Kirchev *et al.*, 2012), (Arya *et al.*, 2017), (Solomon and Shewaye 2018) and (Devech *et al.*, 2018), studied qualitative traits of triticale genotypes and wheat, including protein%, gluten%, and hectoliter weight kg.hl^{-1}.

Materials and Methods

A field experiment was carried out at the Faculty of Agriculture, University of Kirkuk, Agricultural Research and Experimental Station located in the Sayada, in the winter season 2018-2019 with the aim of evaluating the genotypes of triticale for different sowing dates and effect on technological trait. The soil was plowed in two orthogonal plows, the field was leveled and divided according to experiment factorial by split plot with randomize complete block design by three replicates. The study included three sowing dates and (20) genotypes of triticale, according to design. The plant dates 5- Nov., 20- Nov. and 5- Dec. Were distributed in main plot, while the genotypes distributed to the sub plot, each experimental unit was a 4 meter long line, seeds were sown at a depth of (3-5) cm and the distance between the lines 0.3 meter and the grain and the other 0.1 meter. Nitrogen fertilizer was added at 120 kg nitrogen.ha^{-1} in two batches half the quantity in planting and other half at the beginning of the tillage stage, and phosphate fertilizer at 120 kg phosphorus.ha^{-1} in one batch when planting, and agricultural operations were carried out according to plant need, to study the protein%, Hectoliter weight kg.hl^{-1}, wet gluten%, flour strength (min), moisture%, ash%. Data were analyzed statistically using a computer based on the SAS Statistical Analysis System with according experiment design, comparing the means according to the Duncan multiple tests (Dawood and Abdul Elias, 1990).

Results and Discussion

Protein%

Protein percentage in grains is one of the most essential qualities that have studied by many studies because of its relative association with the process of grain processing. (Kirkby and Menegel, 1982)

Table 1 sources of variation shows Non-significant effect of sowing dates for all traits except hectoliter weight kg.hl^{-1} and wet gluten%, also significant genotypes for all traits except moisture% while All the interactions had significant for all traits except protein% and moisture%.

Table 1: Analysis of variance for studied traits.

S.O.V	d.f	M.S		
		Protein%	Hectoliter weight kg.hl^{-1}	Wet gluten %
Replicate	2	64.22	41.68	7.35
Sowing date	2	0.20 n.s	16.57**	33.80 **
Sowing date* Replicate	4	1.69	0.63	0.80
Genotypes	19	8.02 **	73.94 **	114.22 **
Sowing date*Genotypes	38	0.29 n.s	12.88 **	17.43 **
Error	114	1.48	1.37	0.91
S.O.V	**d.f**	**M.S**		
		Flour strength (min.)	**Moisture %**	**Ash %**
Replicate	2	53.31	11.39	0.00
Sowing date	2	5.55 n.s	0.31n.s	2.83n.s
Sowing date* Replicate	4	1.39	0.16	0.93
Genotypes	19	488.32 **	0.32 n.s	0.41**
Sowing date*Genotypes	38	54.55 **	0.25 n.s	0.29**
Error	114	0.94	1.50	0.07

Table 2 shows the mean effect Of sowing dates, genotype and interaction, whereas non-significant of dates for the character of since qualitative traits are not affected by the environmental factors as much as quantitative trait do on the environment reverse quantitative traits, which is great affected by the environment. The genotypes superior CAAL by an average of 15.73%, which differed significantly from all genotypes reverse LIRON-5, which took the lowest mean of this trait of 11.86% it has been

attributed to genetic architecture, the result is agreement with (Ismail and Al-Fahhadi 2012), (Devech *et al.,* 2018), where found significant differences between the genotypes of protein%. While interaction showed the same genotype CAAL at first date superior an average of 16.00%, on same treatments reverse LIRON-5 at third date was taken lowest average 11.70%, but race treatments took to different between high and less for this trait.

Table 2: Sources of variance Effect of sowing date, Genotype and their Interaction in Protein%.

Genotypes	Date of Sowing			Genotypes
	5- Nov.	20- Nov.	5-Dec.	mean
RWAIDA	12.40 d-f	12.90 d-f	13.03 c-e	12.77 d-g
AMAL	12.10 d-f	12.87 d-f	12.91 d-f	12.62 d-g
MOHAND	13.20 c-f	12.63 d-f	12.60 d-f	12.81 d-g
FRAH	12.40 d-f	12.10 d-f	11.80 f	12.10 g
POLLMER	12.50 d-f	12.80 d-f	12.90 d-f	12.73 d-g
LIRON	13.00 d-f	13.00 d-f	13.20 c-f	13.06 b-g
HUI/TUB	14.20 a-f	14.40 a-e	14.50 a-d	14.36 b
HUI/TUB-1	13.00 d-f	14.00 a-f	14.50 a-d	13.83 b-d
CENT/1715	14.00 a-f	13.90 a-f	13.80 a-f	13.90 b-d
BW32-1-1	14.00 a-f	14.00 a-f	13.70 a-f	13.90 b-d
CMH80	12.10 d-f	12.40 d-f	12.72 d-f	12.40 e-g
CMH82	12.20 d-f	13.00 d-f	12.90 d-f	12.70 d-g
POPP-CAAL	13.50 b-f	13.70 a-f	13.80 a-f	13.66 b-e
CAAL	16.00 a	15.70 ab	15.50 a-f	15.73 a
LIRON -1	13.80 a-f	14.10 a-f	14.00 a-f	13.96 b-d
LIRON -2	14.50 a-f	14.20 a-f	14.20 a-f	14.30 bc
LIRON -3	14.00 a-f	13.15 b-f	13.20 c-f	13.57 b-f
LIRON -4	12.80 d-f	13.00 d-f	13.10 c-f	12.96 c-g
LIRON -5	12.00 d-f	11.90 ef	11.70 f	11.86 g
LIRON -6	12.50 d-f	12.20 d-f	12.00 d-f	12.23 f-g
Sowing mean	13.21a	13.31 a	13.30a	

Hectoliter Weight kg.hl^{-1}

The specific grains weight is one of the physical measurements that have a significant role in Grinding and grading of the grains. It gives us an indication of the size of the warehouses used for storing grains as well as giving an idea of the amount of flour produced by a specific size of grains (Al-Azzawi, 2017).

Table 3 shows mean Effects of sowing dates, genotype and its interaction on the qualitative weight kg.hl^{-1}, the second date showed a significant superiority in the desired direction on the first and third dates with an average of 64.48 kg.h^{-1} by difference in sowing dates may be due to the suitability of the environmental conditions of the first date, which allowed the accumulation of dry matter in the grain and full, which reflected on the hectoliter weight kg.hl^{-1} contrary to what is found in the second and third dates, which did not allow environmental conditions and sufficient time to accumulate dry matter and fill the grain, reflected negatively on this trait; this result is consistent with (Ottman, 2014), (Prajapat *et al.,* 2018) as they found differences between sowing dates in qualitative weight as kg. Genotypes LIRON-5 superior with an average of 70.00 which differed significantly from all genotypes, reverse CAAL and LIRON-6 genotypes took less for character between the highest average and the lowest average and may be due to a difference in the genotypes due to the genetic architecture as well as ratios of grain percentage of the chemical composition or genotype is due not superiority in the length spike and number of spikler.spike^{-1}, which led to its superiority in hectoliter weight kg.hl^{-1}, as well as the variation of the genotypes of this characteristic is due to the difference in grain composition in the chemical composition (Ozturk and Aydin 2004) this result agreement with (Kumar *et al.,* 2013), (Singh, 2016) were found significant differences between genotypes for qualitative weight trait kg.

The interaction treatment genotype LIRON-5 at the third date, the highest mean was 71.00, which was not

Table 3: Sources of variance effect of sowing date, genotype, and interaction in hectoliter weight kg.hl^{-1}.

Genotypes	Date of Sowing			Genotypes
	5- Nov.	20- Nov.	5-Dec.	mean
RWAIDA	62.00 f-h	63.00 e-g	63.00 e-g	62.66 gh
AMAL	65.00 c-e	66.00 c-d	65.00 c-e	65.33 d
MOHAND	63.00 e-g	61.00 g-i	66.00 cd	63.33 f-h
FRAH	65.00 c-e	65.00 c-e	66.00 cd	65.33 d
POLLMER	63.00 e-g	67.00 b-c	61.00 g-i	63.66 e-g
LIRON	62.00 f-h	65.00 c-e	63.00 e-g	63.33 f-h
HUI/TUB	62.00 f-h	61.61 g-i	61.00 g-i	61.22 i
HUI/TUB-1	61.00 g-i	66.00 cd	62.00 f-h	63.00 f-h
CENT/1715	61.00 g-i	62.00 f-h	61.00 g-i	61.33 i
BW32-1-1	65.00 c-e	65.00 c-e	61.00 g-i	63.33 e-g
CMH80	66.00 cd	70.00 a	65.00 c-e	67.00 c
CMH82	61.00 g-i	64.00 d-f	62.00 f-h	62.33 hi
POPP-CAAL	62.00 f-h	65.00 c-e	65.00 c-e	64.00 ef
CAAL	59.00 i-k	61.00 g-i	57.00 k	59.00 j
LIRON -1	65.00 c-e	62.00 f-h	62.00 f-h	63.00 f-h
LIRON -2	65.00 c-e	60.00 h-g	69.00 ab	64.66 d-e
LIRON -3	69.00 ab	70.00 a	66.00 cd	68.33 b
LIRON -4	70.00 a	69.00 ab	65.00 c-e	68.00 bc
LIRON -5	69.00 ab	70.00 a	71.00 a	70.00 a
LIRON -6	61.00 g-i	58.00 j-k	58.00 jk	59.00 j
Sowing mean	63.880 b	64.48 a	63.45	

significantly different from the genotype CMH80, LIRON-5 and LIRON-3 at second date and genotype LIRON-4 at first date, which took an average 70.00 for all, reverse treatment of genotype CAAL at third date as it reached 57.00, the significant due interaction to genetic architecture and its response to plant date led to increasing accumulate dry matter reflected positively on this trait.

Wet gluten%

Table 4 shows the mean effect of sowing date, genotype and Their interaction on wet gluten%. The first date showed a significant superiority on second and third dates with an average of 15.30% which may be attributed to the different dates of planting due to the environmental conditions of the first date reverse to second and third dates, which reflected in this trait, This result is in agreement with (Singh, 2016) was found differences between sowing dates for gluten%. While genotypes superior the LIRON genotype an average of 21.00% which was not significantly differed with CENT\1715 genotype, which gave an average of 20.33 And differed from all other genotypes, reverse genotype LIRON-5, With less average performance 8.33% which different from all other genotypes. This result agreement with (Ismail and Al- Fahdi 2012), (Salehi and Arzani 2013), (Singh, 2016), (Devech *et al.*, 2018) were found significant differences between genotypes for gluten%. The rest genotypes have taken the difference between the highest average and the lowest average may be due to genetic architecture difference between genotypes, while interaction have same genotype LIRON at third date superior an average of 22.00 about some other treatments revers treatment Liron-5 genotype at first date, which took the lowest average of 7.00, which differed from most other treatments.

Flour strength (min)

Table 5 shows mean effect of sowing date, genotype and interaction in flour strength (min) notes did not Respond significantly to of sowing date while Genotypes gave MOHAND genotype the highest duration of rupture of the dough ball with an average of 52.00 minutes, which differed significantly with all genotypes, while AMAL and HUI\TUB-1 recorded the lowest duration of rupture of the dough ball with an average of 25.00 minutes each and the genotypes rest took the difference between the lowest and the highest average for this trait where the low values of this trait indicate that unfavorable triticale dough for bread making but interaction showed That the same genotype MOHAND at third date with an average

Table 4: Sources of variation effect of sowing date, genotype, and interaction in wet gluten%.

Genotypes	Date of Sowing			Genotypes
	5- Nov.	20- Nov.	5-Dec.	mean
RWAIDA	17.00 ef	18.00 de	20.00 bc	18.33 b
AMAL	18.00 de	20.00 bc	17.00 ef	18.33 b
MOHAND	20.00 bc	17.00 ef	15.00 g	17.33 cd
FRAH	19.00 cd	18.00 de	13.00 h	16.66 d
POLLMER	16.00 fg	12.00 hi	10.00 jk	12.66 g
LIRON	2100 ab	20.00 bc	22.00 a	21.00 a
HUI/TUB	17.00 ef	15.00 g	12.00 hi	14.66 ef
HUI/TUB-1	16.00 fg	15.00 g	12.00 hi	14.33 f
CENT/1715	20.00 bc	20.00 bc	2100 ab	20.33 a
BW32-1-1	10.00 jk	8.00 l-m	11.00 ij	9.66 i
CMH80	10.00 jk	10.00 jk	12.00 hi	10.66 h
CMH82	12.00 hi	17.00 ef	15.00 g	14.66 ef
POPP-CAAL	15.00 g	18.00 d-e	20.00 bc	17.66 bc
CAAL	21.00 ab	13.00 h	9.00 kl	14.33 f
LIRON -1	10.00 jk	12.00 hi	11.00 ij	11.00 h
LIRON -2	11.00 ij	10.00 jk	12.00 hi	11.00 h
LIRON -3	15.00 g	11.00 ij	11.00 ij	12.33 g
LIRON -4	16.00 fg	12.00 hi	10.00 jk	12.66 g
LIRON -5	7.00 m	8.00 lm	10.00 jk	8.33 j
LIRON -6	15.00 g	18.00 de	13.00 h	15.33 e
Sowing mean	15.30 a	14.60 b	13.80 c	

Table 5: Sources of variation, the effect of sowing date, genotype and them interaction in flour strength.

Genotypes	Date of Sowing			Genotypes
	5- Nov.	20- Nov.	5-Dec.	mean
RWAIDA	31.00 o-p	25.00 r	35.00 m	30.33 j
AMAL	25.00 r	22.00 st	28.00 q	25.00 l
MOHAND	49.00 c	52.00 b	55.00 a	52.00 a
FRAH	40.00 hi	35.00 m	38.00 jk	37.66 g
POLLMER	53.00 b	47.00 d	50.00 c	50.00 b
LIRON	42.00 fg	49.00 c	37.00 kl	42.66 d
HUI/TUB	38.00 jk	35.00 m	40.00 hi	37.66 g
HUI/TUB-1	25.00 r	23.00 s	27.00 q	25.00 l
CENT/1715	41.00 gh	40.00 hi	39.00 ij	40.00 f
BW32-1-1	33.00 n	35.00 m	30.00 p	32.00 i
CMH80	40.00 hi	32.00 no	39.00 ij	37.00 g
CMH82	42.00 fg	45.00 e	38.00 jk	41.66 e
POPP-CAAL	31.00 op	40.00 h-i	35.00 m	35.33 h
CAAL	36.00 lm	42.00 fg	33.00 n	37.00 g
LIRON -1	46.00 de	35.00 m	50.00 c	43.66 c
LIRON -2	31.00 op	40.00 i	28.00 q	33.00 i
LIRON -3	32.00 no	27.00 q	33.00 n	30.66 j
LIRON -4	43.00 f	45.00 e	41.00 gh	43.00 cd
LIRON -5	21.00 t	33.00 n	30.00 p	28.00 k
LIRON -6	35.00 m	33.00 n	39.00i j	35.66 h
Sowing mean	36.70 a	36.75 a	37.25 a	

of 55.00 significantly superior to all other treatment reverse genotype LIRON-5 at first date, which gave an average of 21.00 minutes, which differed significantly on all treatment other, the interaction treatment possessed the difference between the highest average and the lowest average due these different values was the response the genotypes to the growth conditions which was reflected in this trait.

Moisture%

Moisture is an essential factor in technological qualities Estimation of dry matter accumulated in grains the determined quality of flour by its value as well as its importance in the storage process whenever lower the moisture content the less incidence of fungi (Michael,1978).

Ash%

Ash percentage is one of the traits that Expresses the grain content of mineral elements such as magnesium, sodium, and calcium as well as protein, which significantly affects the percentage of ash in grains.

Table 7 shows mean effect of sowing date, genotype, and interaction on ash%, notes did not Achieved significant differences between dates, while genotypes superior genotype CMH82 Produced it the lowest ash of 1.14% which did not differ significantly with most genotypes, reverse genotypes POPP-CAAL That gave the highest value of the ash of 1.94% which also did not sign with most genotypes, the genotypes have higher and less in ash%, may are due to their differences in ash% or absorption of nutrients and their effect on environmental conditions (Al-Fakhry and Khalaf, 1983). This result is consistent with (Darvey *et al.*, 2000) were found significant differences between genotype in this trait. While interaction was superior for MOHAND genotype at second plant date by an average of 0.73%, which did not differ from some there treatments reverse the genotype HUI\TUB at the first date with an average of 2.61% and the rest treatments took the difference between the highest value and the lowest Values for ash%.

Table 6: Sources of variation effect of sowing date, Genotype, and them interaction in moisture%

Genotypes	Date of Sowing			Genotypes mean
	5-Nov.	20-Nov.	5-Dec.	
RWAIDA	7.90 a	8.20 a	8.10 a	8.00 a
AMAL	7.40 a	7.70 a	7.90 a	7.66 a
MOHAND	8.10 a	8.10 a	7.60 a	7.93 a
FRAH	8.10 a	7.90 a	7.70 a	7.90 a
POLLMER	7.80 a	7.20 a	7.70 a	7.56 a
LIRON	7.10 a	7.80 a	7.60 a	7.50 a
HUI/TUB	7.80 a	7.40 a	7.80 a	7.66 a
HUI/TUB-1	7.80 a	7.80 a	7.80 a	7.80 a
CENT/1715	7.80 a	7.50 a	7.60 a	7.63 a
BW32-1-1	8.10 a	7.80 a	7.40 a	7.76 a
CMH80	7.50 a	7.20 a	7.10 a	7.26 a
CMH82	7.80 a	7.80 a	7.20 a	7.60 a
POPP-CAAL	8.00 a	7.60 a	7.60 a	7.73 a
CAAL	7.90 a	7.80 a	7.80 a	7.60 a
LIRON -1	7.10 a	7.10 a	8.00 a	7.40 a
LIRON -2	7.70 a	7.60 a	8.10 a	7.80 a
LIRON-3	8.20 a	7.50 a	8.00 a	7.90 a
LIRON -4	7.80 a	7.60 a	7.10 a	7.50 a
LIRON -5	7.80 a	7.60 a	7.80 a	7.73 a
LIRON -6	7.60 a	8.10 a	7.90 a	7.86 a
Sowing mean	7.76 a	7.62 a	7.69 a	

Table 7: Sources of variation mean effect of sowing date, genotype, and the interaction in ash %.

Genotypes	Date of Sowing			Genotypes mean
	5-Nov.	20-Nov.	5-Dec.	
RWAIDA	2.06 b-d	1.10 m-p	1.36 h-o	1.50 d-i
AMAL	1.93 b-g	1.07 op	1.08 n-p	1.34 g-j
MOHAND	1.74 b-l	0.73 p	1.29 g-o	1.25 ij
FRAH	1.69 b-l	1.22 m-p	1.04 op	1.31 h-j
POLLMER	1.45 f-o	1.42 f-o	2.08 bc	1.65 a-g
LIRON	2.03 b-e	1.51 c-o	1.49 d-o	1.67 a-f
HUI/TUB	2.61 a	1.24 k-o	1.77 b-l	1.87 ab
HUI/TUB-1	1.84 b-j	1.12 m-p	1.30 i-o	1.42 e-j
CENT/1715	1.26 k-p	1.33 i-o	1.38 g-o	1.32 h-j
BW32-1-1	1.97 b-f	1.72 b-l	1.04 op	1.57 b-h
CMH80	1.99 b-f	1.84 b-j	1.57 b-o	1.80 a-c
CMH82	1.12 m-p	1.24 k-p	1.08 n-p	1.14 j
POPP-CAAL	1.09 b	1.93 b-h	1.81 b-k	1.94 a
CAAL	1.47 e-o	1.62 b-m	1.22 m-p	1.43 d-j
LIRON -1	1.87 b-i	1.85 b-j	1.42 f-o	1.71 a-e
LIRON -2	1.49 e-o	1.64 b-n	1.55 b-o	1.56 c-i
LIRON -3	1.66 b-m	1.53 b-o	2.03 b-e	1.74 a-d
LIRON -4	1.97 b-f	1.11 m-p	1.09 m-p	1.39 f-j
LIRON -5	1.93 b-h	2.04 b-e	1.00 op	1.65 a-g
LIRON -6	1.74 b-l	1.65 b-n	1.38 g-o	1.59 b-g
Sowing mean	1.79 a	1.44 a	1.39 a	

Conclusion

Results show non-significant sowing date for most traits. While genotypes superior CAAL genotype in protein%, LIRON-5 genotype in hectoliter weight, LIRON genotype in wet gluten, MOHAND genotypes in flour strength and CMH82 genotype in ash%. The interaction show superior the first, second and third dates

with the genotypes CAAL, LIRON-5, LIRON and MOHAND in studies traits.

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