Evaluation of different seed rates effects on phenological and morphological traits and seed yield of soybean varieties in Mazandaran province

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Abstract: In order to evaluation of different seed rates on phenological and morphological traits and seed yield of soybean varieties, an experiment was laid out in split-plot based on randomized complete block design with four replications at Dashtenaz region of Mazandaran province in 2013. Main plot was seed rates including 55, 70 and 85 kg.ha^{-1} and sub plots were six soybean cultivars including Sari (JK), Telar (BP), Caspian (0.33), Nekador (0.32), Katoul (DPX) and Sahar (Pershing). Results showed that seed rates had significant effects on all the traits. The varieties were different for all the traits. Non-significant interaction effects of seed rates and cultivars for most of the traits except duration of flowering and first pod height from earth indicating that variations of the traits of each cultivar had similar trend in different seed rates. Average seed yield of the genotypes for 55, 70 and 85 kg.ha^{-1} were 2999, 3246 and 2700 kg.ha^{-1}, respectively. Correlation analysis showed that on average the interaction of seed varieties during the flowering period the figures are influenced by the number of days to flowering and days to be processed. There is a significant positive correlation between seed weight, number of days to flowering and duration of flowering also represents the additive effects of these traits on grain yield. Also, a significant positive correlation between yield components like number of pods per plant, seed weight and seed yield and harvest index suggests that any changes in these traits will have a major role on grain yield.

[Hamideh Semnaninejad, Mohammad Javad Mirhadi. **Evaluation of different seed rates effects on phenological and morphological traits and seed yield of soybean varieties in Mazandaran province.** *Researcher* 2014;6(11):23-26]. (ISSN: 1553-9865). http://www.sciencepub.net/researcher. 4

Key words: interaction effects, phenological traits, soybean, split plot, yield

1. Introduction

Soybean (Glycine max L.) dicot annual plants of the family Papilionaceae is one of the most important oilseed many uses in agriculture and industry. The value of this product because too much oil and seed protein is abundant, respectively about 20 and 40% of grain weight and is included as yellow gold is allocated to plant. Figures varied reactions to changes in density and growth areas, requires the genetic potential for productivity of the environment (6, 10). With a 18 to 22 percent soybean oil contains a balanced combination of saturated and unsaturated fatty acids; 40 to 42 percent protein and also contains a balanced combination of amino acids ranked first in the world in terms of production of certified seeds (2).

New cultivars have an important role in increasing the yield and tolerance to environmental stresses. In order to increase the efficiency of selection in generations of segregation and selection to understand and analyze the characteristics of the study will be necessary to specify selection criteria (3). Simple correlation coefficients are often used to study the relationship between plant traits and seed yield are used together, the result is gene linkage and tropane and Pliothropy effects (5).

Rezaei Nejad et al. examined 240 genotypes of soybean seeds per pod and seed weight has a direct effect on grain yield had a positive and significant (12). Ball et al. investigated the relationship between yield and yield components of different densities stated that the number of pods and seeds per pod has a positive direct effect on grain yield (4). Arshad et al. reported on a study of 32 soybean genotypes that yield significant positive correlation with pod length, number of branches, number of pods and seed weight. In this study the number of branches, pod length and seed weight has a direct effect on grain yield was positive (2).

Walker et al. investigated the effects of plant population and row spacing on soybean maturity group on three cultivars Asgrow, Pionear, 93M90 and narrow rows between rows 38 and 76 cm declared the overall performance of greater or equal to the performance produced from wide rows (14). Akond et al. investigated the effect of row spacing on agronomic traits of soybean reported that performance is affected by changes in plant population and row spacing are. Optimum density for maximum yield in soybean agriculture is important (1). Kane et al. investigated the physiological response of soybean genotypes to plant densities reported that in all the genotypes yield was higher in high density compared to low density (9). The reduction in seed yield, low density and a decrease in the number of pods and seeds per unit area are linked. Different density may have significant effects on soybean yield qualitative features. In various experiments, Nezami and Taghizadeh said that with increasing plant density of

soybean, Protein and oil content of the product increases and decreases, respectively (11, 13).

Kuber and welding said that increasing density decreased seed oil content and protein is increased. In this regard, several investigators have reported that an inverse relationship exists between the amount of protein and oil, and a negative correlation between them (7). Pots and colleagues reported that the density is less because the amount of solar energy per unit area of canopy is at its highest value. Yield compared with density greater than the density increases fell due to lower net energy than the ground and the amount of vegetation, grain yield also increased (8).

Materials and Methods

To determine the effect of seeding rates on hybrids, morphological and yield of soybean cultivars, an experiment based on randomized complete block design with a split plot with four replications in the growing seasons of 2013 were conducted in the Dashtenaz area of Mazandaran province which has warm summers and cold, wet winters, and annual rainfall is 560 mm. To determine soil characteristics (texture and chemical properties of the soil) before running the experiment was to take samples of soil.

To do so, the depth of 0-30 cm at some point in the sampling plan was considered. After mixing the samples and the preparation of a composite sample was sent to Soil Lab selected field (Table 1).

Table 1. Physical and chemical properties of the test soil before planting

Type of tissue	Soil texture (Percent)			Soil potassium (P.P.M)	Soil phosphorus (P.P.M)	Organic carbon (o.c) Percent	(O.M) Percent	neutralizing substances %T.N.V	E.C. $EC\times10^3$	Percent saturation (s.p)	Soil pH	Soil depth (Cm)
	clay	silt	Sand									
Loamy	20	30	50	180	13.6	1.2	2.2	30	0.68	50	7.6	0-30

Seeding rates of 55, 70 and 85 kg per ha as the main factors and varieties of soybeans including Sari (JK), Telar (BP), Caspian (0.33), Nekador (0.32), Katoul(DPX) and Sahar(Pershing) were considered as minor factors. All figures are in terms of growth habit semi-limited growth (Semi-determinate), and they are resistant to lodging and shattering charcoal rot disease. Amounts of fertilizer based on soil test is equivalent to 120 kg and 150 kg/ha of triple superphosphate, potassium sulphate and 50 kg urea, 50 kg and 20 kg/ha, manganese sulfate, zinc sulfate has been used before planting after spraying manure mixed with soil testing plan was implemented. In addition, during the Rhizobium bacteria to inoculate the seed was planted. Planting the seed of values based treatments used in experimental plots, each plot was six rows spaced 40 cm length of five meters and was and the distance between plants on-line according to seeding rate and seed weight in different varieties and about 4 to 8 cm, respectively. After a deal with the deletion function to calculate a row on both sides of the border, each plot was harvested separately based grains after threshing and drying and weighing 12 kg ha became moisture. The characterization of phenological, morphological and yield were investigated. Soxhlet apparatus was used to measure the amount of oil and then multiplying the percentage of oil in the oil yield in kilograms per hectare yield is calculated for each treatment. Statistical analysis using SAS and MSTAT-C statistical software and Excel were then analyzed by statistical means were compared by Duncan's multiple range. The characterization of phenological, morphological, yield and function were examined. Pearson correlation was used to determine the relationships of the characters.

Results and Discussion

The results of the analysis based on the split-plot design indicated that the effect of the seed rates was significant in all characteristics. The cultivars have had significant difference regarding all the studied characteristics (Table 2). Non-significant interaction effects of seed rates and cultivars for most of the traits except duration of flowering and first pod height from earth indicating that variations of the traits of each cultivar had similar trend in different seed rates. Increased seeding rate due to increased competition between plant height increased, but phenological characteristics decreased. Maximum number of days to flowering varieties of Sari and has been Katoul (Table 3). Among cultivars and varieties of magic in cultivars were Telar and Sahar. Average seed yield of the genotypes for 55, 70 and 85 $kg.ha^{-1}$ were 2999, 3246 and 2700 $kg.ha^{-1}$, respectively. Results of analysis on the interaction between the seed and the figures showed that the average duration of flowering cultivars, influenced by the number of days to flowering and days to maturity. The significant positive correlation between seed weight and the number of days to flowering and duration of flowering represents the additive effects of these traits on grain yield. The significant positive correlation of yield components like number of pods per plant, grain weight, and grain yield and harvest index also indicates that any changes in these factors will have a major role on grain yield. The regression analysis showed that seed weight is the most important trait in

explaining yield a positive coefficient in the model and then plant a negative coefficient in the model (Table 4). Ball et al. investigated the relationship between yield and yield components of different densities stated that the number of pods and seeds per pod has a positive direct effect on grain yield (4).

Table 2- Analysis of variance for Phenological and Morphological Characteristics and seed yield in soybean cultivars

Mean-square (MS)							*df*	Sources of variation
Seed yield ($kg.ha^{-1}$)	Pod's height from surface	Plant height	Days to maturity	Flowering period	Days to End of flowering	Days to flowering		
537071*	18.7*	145.9*	4.3	68.5*	5.3	103.4 **	3	Repetition
1795455**	511.7**	333.7*	86.5**	54.2*	198.5**	104.1**	2	Seed rate (a)
103865	3.5	31.1	1.8	7.2	1.9	2.7	6	Error
1786088**	75.7**	4011.6**	773.7**	202.3**	653.8**	139.9**	5	Figure (b)
114311	14.9**	16.6	2.1	13.8*	11.1	1.5	10	a×b
108370	4.3	27.7	4.9	6.2	2.2	4.0	45	Error
11.1	16.6	12.4	6.7	6.3	1.5	3.5	-	Coefficient of Variation (%)

*, ** Significant at p=0.05 and 0.01 level, respectively

Table 3- Mean comparison of the effect of seed rates, soybean cultivars and their interaction effects on Morphological and Phonological Characteristics and seed yield.

Seed yield ($kg.ha^{-1}$)	Pod's height from surface (cm)	Plant height (cm)	Days to maturity	Flowering period	Days to End of flowering	Days to flowering	**Traits** / Factors
2999ab	11.8c	75.5b	148.4a	40.0a	99.9a	60.0a	55 $kg.ha^{-1}$
3246a	17.3b	77.8ab	147.6a	40.8a	97.3b	56.4b	70 $kg.ha^{-1}$
2700b	21.1a	82.8a	144.8b	37.9b	94.2c	56.3b	85 $kg.ha^{-1}$
3024bc	15.9bc	75c	153.2b	42.2b	104.2b	62a	Sari (JK)
2855bcd	17.4bc	54.6e	140.7e	36.9de	90e	53.1e	Telar (BP)
3141b	18.3ab	96.9b	145.7d	40.2bc	98.8c	58.7bc	Caspian (033)
3626a	20.3a	75.4c	149.8c	38cd	94.7d	56.7cd	Nekador (032)
2690CD	15.5C	103.2A	156.9A	45.9A	106.3A	60.3AB	Katoul(DPX)
2536D	12.9D	67.1D	135.3F	34.3E	88.9F	54.6DE	Sahar(Pershing)

In each group of average comparison, those averages that have at least one trait in common do not have significant difference.

Table 4- Correlation coefficients of selected soybean cultivars in different planting densities

10	9	8	7	6	5	4	3	2	1	Traits
									1	1. Number of days to flowering
								1	0.67**	2. The flowering period
							1	0.86**	0.77**	3. Days to maturity
						1	0.57*	0.63**	0.53*	4. Plant height
					1	0.27	0.23	0.23	0.03	5. The number of pods on the main stem
				1	-0.35	0.18	0.53*	0.34	0.78**	6. The number of pods per plant
			1	0.27	-0.04	0.51*	0.81**	0.66**	0.63**	7. thousand kernel weight
		1	0.56*	0.40	-0.24	-0.02	0.33	0.14	0.13	8. grain yield
	1	0.50*	0.31	0.65**	-0.45	-0.56*	0.04	-0.05	0.17	9. Harvest Index
1	0.60**	0.94**	0.61**	0.54*	-0.42	-0.16	0.34	0.13	0.21	10. Oil Performance

* And **: significant at probability level five and one percent, respectively.

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10/28/2014