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Research article

COMPARISON OF SOME GROWTH AND YIELD PERFORMANCE OF SOYBEAN VARIETIES (*Glycine max* L.)

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ABSTRACT: Selection of suitable variety for an agro-climatic zone is of prime concern for soybean growers. Moreover, identification of suitable plant traits showing maximum contribution to final seeds yield is important for plant architects. Experiment was laid out in randomized complete block design (RCBD). Soybean variety LV19 showed best performance as it gave significantly higher plant height (36.48 cm), leaflet and leaf area (15.66 and 46 cm^2), No. of branches per plant (6.66), No. of pods $plant^{-1}$(79.66), biomass (83.45 g), Pods weight per plant (34.15 g), 100-seeds weight (9.3 g) and seeds yield per plant (25.66 g). Contrastingly, soybean variety LV88 was found to be inferior as it gave lowest value for most parameters. Seeds yield showed a significant positive relationship with leaflet are (R^2=0.89), leaf area (R^2=0.909), No. of branches per plant (R^2=0.64), and plant biomass (R^2=0.63), No. of pod per plant (R^2=0.73) and pods weight (R^2=0.73) where as non-significant negative relationship with plant height (R^2=0.21) and 100-seeds weight (R^2=0.44) was observed. The strongest relationship of seeds yield was seen with number of branches per plant (b=1.65) followed and the weakest with plant biomass (b=0.02). Therefore this traitshould be considered to be most important while selecting improved soybean genotypes under semi-arid conditions.
Key words: Soybean varieties, Seed yield, Plant traits, Regression

INTRODUCTION

Soybean (*Glycine max* L.) is an important legume crop. It originated from East Asia but it is well adapted to tropical, subtropical and temperate regions of the world, and can be successfully grown during spring as well as the summer season. United States, Brazil, Argentina, China, India, Paraguay and Canada are the major soybean producers in world. It is now becoming important valuable crop of other countries because it is a major source of protein, energy, polyunsaturated fat, fibers, vitamins, minerals, both for humans and live stock. Soybean seed contain 40-42% good quality protein and18-22% oil, depending upon genetic and environmental factors [1]. It is multi-dimensional in its uses but widely grown for its edible beans. Due to rich in best quality protein it is regarded as “the meat that grows on plant”. Soybean plant is classified as oilseed rather than pulse crop as approximately 85% of the world's soybean crop is processed into soybean meal and vegetable oil. In Iraq, it is categorized as one of the non-conventional oil seed crops. In Kurdistan, there has been a gradual decline in area and production of soybean. The main reason behind was lack of knowledge regarding identification of soybean varieties suitable for different agro ecological zones of country.

For the proper understanding of seed yield performance of any crop cultivar under specific set of environmental conditions, it is necessary to study the contribution of various yield determining parameters towards final seed yield. It will not only help in selecting suitable variety for an agro ecological zone but also provide guideline for breeder to develop improved variety of a certain crop. The agronomic practices of soybean are best optimized when a systematic approach to management is utilized with the understanding of soil types, climate conditions, pest concerns, fertility requirements, and equipment capacities for a producers operation. Producers can only plan ahead for, or react to, the conditions they have for many of these factors. However, the agronomic factors most easily controlled by the grower include when the crop is planted, how many seeds are planted, and in what row spacing, or arrangement, the seeds are placed.

Therefore correlation and regression studies among yield and yield contributing traits of soybean may provide knowledge which will be of greater significance for agronomists and plant breeders in manipulation in any crop improvement programmed as economic yield is the result of the expression and association of several plant growth components [2].

Previous studies in different parts of the world suggested various plant traits which should be considered to be most important while selecting soybean genotypes for higher seed yield. Plant height at harvest, number of pods per plant, weight of 100 seeds and seed yield were used to assess the performance of improved varieties of soybean. The newly recommended improved varieties of soybean have a wide range of maturity and diverse morphology [3,4]. Similarly it was reported by Jin *et al.* [5] that the yield increase is correlated with increasing pod number, while seed size and seeds per pod does not change greatly over time. Khan *et al.*, [6] studied heritability and correlation among yield determining components of 86 genotypes in Pakistan and reported that seed yield had a significant positive relationship with all yield components except pod height. The aim of this study was planned to evaluate the growth and yield performance of soybean varieties.

MATERIALS AND METHODS

Field experiment was performed at research area of Faculty of Agricultural Sciences, University of Sulaimani, during spring season of 2013 to evaluate the growth and yield performance of soybean varieties. Three soybean varieties viz., LV12, LV19 and LV88were tested. Experiment was laid out in a randomized complete block design (RCBD) and each treatment was replicated three times. A net plot size of 3 m x 1.5 m was kept. The crop was sown during first week of 16, April by hand. Seed rate of 40 kg ha^{-1} was kept while maintaining row distance of 40 cm and plant to plant distance of 30 cm. NPK in the form of urea, DAP and potassium sulphate, respectively, at the rate of 60-75-30 kg ha-1 was applied. Full dose of each of nitrogen, phosphorus and potassium was applied basally. After 1stirrigation, weeds were removed by hoeing. All other agronomic practices were kept uniform among treatments applied. The amount of water that was applied by irrigation was not available; however, irrigation was applied as needed to keep plants from showing water deficit stress. Weeding was done by hand hoeing and/ or hand pulling when weeds were tender. Weeding began two weeks after planting until peg formation, to ensure that pegs are not destroyed. Parameters related to plant growth and yields such as, plant height, leaflet area, leaf area, number of branches per plant, number of pods per plant, plant biomass, 100-seeds weight and seed yield, wererecorded for analysis. The data thus collected were analyzed statistically by the analysis of variance technique and treatment means were compared using Duncan test at 5 % level of probability [7].To assess the relationship of seed yield with other parameters, regression analyses were performed on XLSTAT software.The leaf and leaflet area was measured by Image Lab software.

RESULTS AND DISCUSSIONS

The mean squares from the analysis of variance for growth and yield of soybean are presented in Table 1. The difference among soybean varieties was significant for the agronomic characters investigated. The plant height varied significantly among varieties (Table 2). The tallest plant (36.48 cm) was observed in LV19 which was statistically identical with LV12. The lowest height was found in variety LV12. Similar reports are presented by Ponnuswamy *et al.*, [8] who observed that plant height differed between varieties Co-1 and PK-472. The plant height variation among the varieties might be related to their genetic makeup. Data of means of leaflet and leaf area of different soybean varieties are given in table 1 and 2. These data reveals that soybean variety LV19 produced significantly highest Leaflet and leaf area (15.66 and 46). However, lowest leaflet and leaf area (11.9 and 32.66 were observed in soybean variety LV88 which was statistically identical with LV12. The increasing of leaflet and leaf area leads to increasing to photosynthesis activity and accumulation of dry matter.

The number of branches per plant was difference significantly among varieties (Table 1 and 2). The highest number of branches per plant was produced by varietyLV19 (6.66), while the lowest number of branches per plant was found in variety LV88 (4.33) which also statistically identical with LV12. The results are supported with the findings of Ghatge & Kadu [9] and Rasaily *et al.*, [10] who obtained considerable genotypic variability for this character. Data of means of plant biomass of different soybean varieties are shown in table-1. The result revealed that soybean variety LV19produced significantly highest biomass (83.45 g). However, lowest biomass (67.94 g) was observed in soybean variety LV12. Biomass has increased as a result of an increasing of photosynthesis activity. It was LV19, however, that gave the highest values for average number of pods per plant (79.66) and LV88 gave the lowest value for number of pods per plant (50.33) (Table 3). The range of pods weight was between 16.25 (LV88) and 34.12 (LV19) (Table 3). The results are well supported by the findings of Ghatge & Kadu [9] who observed high variability for Pod weight.

However100 seeds weight varied significantly among different soybean varieties. However, highest 100 seeds weight (9.3 g) was given bysoybean variety LV19 while the lowest by LV12.Maximum seeds yield (25.66) was observed in LV19 while the minimum seeds yield was showed by LV88 (Table 3).

Table 1. Mean square values from the analysis of variance for growth and yield of soybean.

Source	Plant height (cm)	Leaflet area (cm^2)	Leaf area (cm^2)	No. of branches/plant	Biomass/plant (g)	No. of pods/plant	Pods weight (g)/plant	100-seeds weight (g)	Seeds yield (g)/plant
Block	1.32	0.68	1.00	0.11	69.39	5.77	17.46	6.3	0.11
Varieties	5.50*	11.60*	149.33*	4.11*	181.37*	664.11*	246.58*	68.7*	18.77*
Error	0.55	1.21	8.33	0.44	19.23	28.11	21.00	4.7	1.44

Table 2. Comparison of some growth characters in soybean varieties.

Varieties	Plant height (cm)	Leaflet area (cm^2)	Leaf area (cm^2)	No. of branches/plant	Biomass (g)/plant
LV12	33.9b	12.8 b	35.33b	5.33ab	67.94b
LV19	36.48a	15.66a	46a	6.66a	83.45a
LV88	35.88a	11.9b	32.66b	4.33b	74.76ab

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test

Table 3. Comparison of some yield characters in soybean varieties.

Varieties	No. of pods/plant	Pods weight/plant (g)	100-seeds weight (g)	Seeds yield/plant (g)
LV12	60.66b	22.71b	8.4b	21.3b
LV19	79.66a	34.15a	9.3a	25.66a
LV88	50.33b	16.25b	8.9a	20.33b

Similar letters are not significantly different at the 0.05 level of probability according to Duncan Multiple Range Test

Regression analyses as presented in figures 2, 3, 4, 5, 6 and 7 indicated a significant relationship of seed yield with leaflet and leaf area, number of branches per plant, plant biomass, number of pods per plant, and pod weight at 5% probability level. However non-significant negative relationship of seed yield was found with plant height and 100. seeds weight (Figure 1 and 8).Regression analyses of seed yield with vegetative growth parameters revealed a strong positive relationship of seed yield with leaflet are (R^2=0.89), leaf area (R^2=0.909), No. of branches per plant (R^2=0.64), and plant biomass (R^2=0.63). As regards yield components, seed yield was found to have a strong positive relationship with No. of pod per plant (R^2=0.73) and pod weight (R^2=0.73). Among regression analyses of seed yield with all parameter studied, highest value of regression coefficient (b=1.65) was observed with number of branches per plant (Figure 4), whereas lowest value of regression coefficient (b=0.02) was seen with plant biomass (Figure 5).

Our results are in close conformity to those of previous investigators who also found plant height [11], number of pods and seeds [12, 13, 14] to be the most important plant traits contributing to improved economic yield in soybean crop and hence suggested that these traits should be given more importance while selecting superior soybean genotypes. Although plant height had no direct influence on final seed yield even tall statured soybean varieties produced larger number of leaves which in turn supplied greater amounts of assimilates for seed growth resulting in higher seed yield.

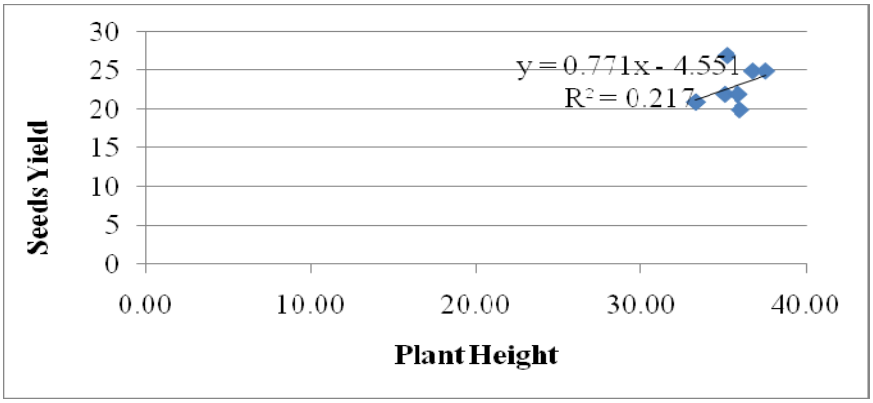

Figure 1: Regression analysis of seeds yield as affected by plant height (cm).

Similarly plants of soybean varieties with tall height had longer growth duration which resulted in larger number of pods and seeds. Moreover, the positive relationship of seed yield with number of pods was probably due to fact that these are the yield components of important nature in soybean.

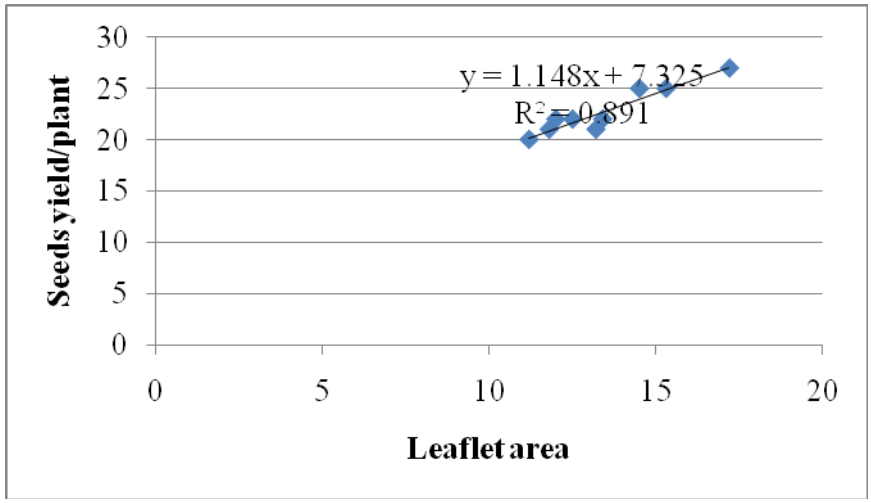

Figure 2: Regression analysis of seeds yield as affected by leaflet area (cm^2).

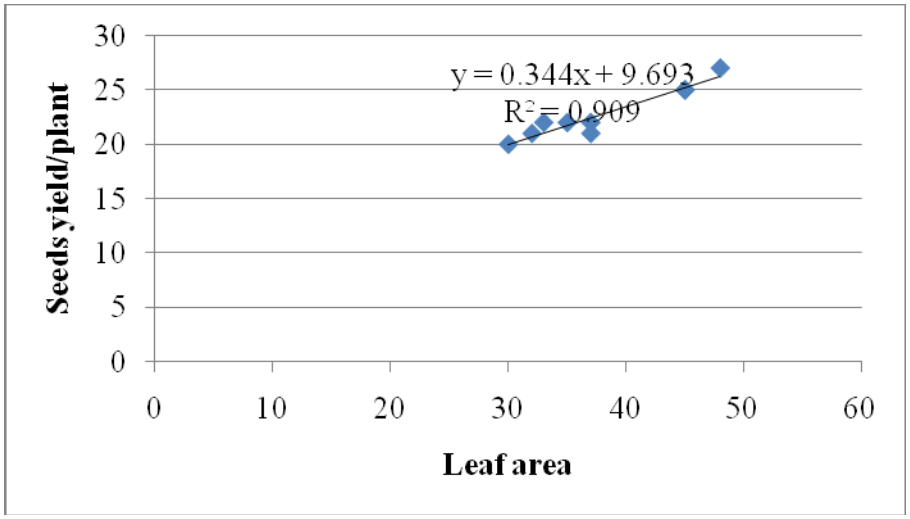

Figure 3: Regression analysis of seeds yield as affected by leaf area (cm^2).

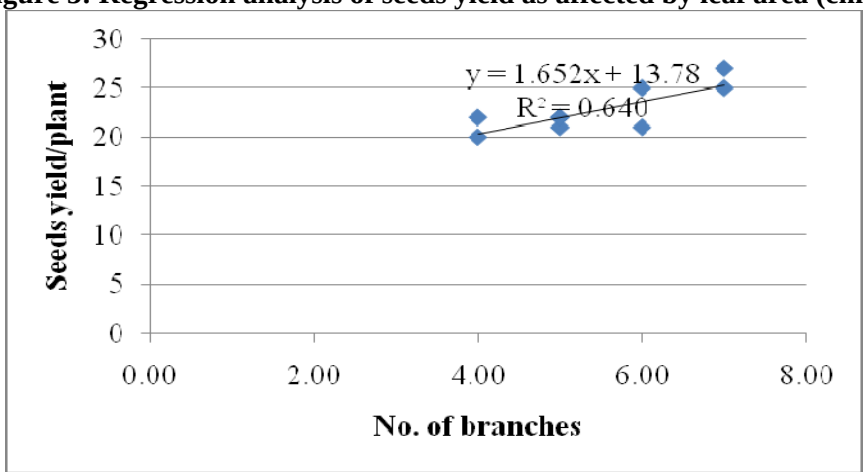

Figure 4: Regression analysis of seeds yield as affected by No. of branches per plant

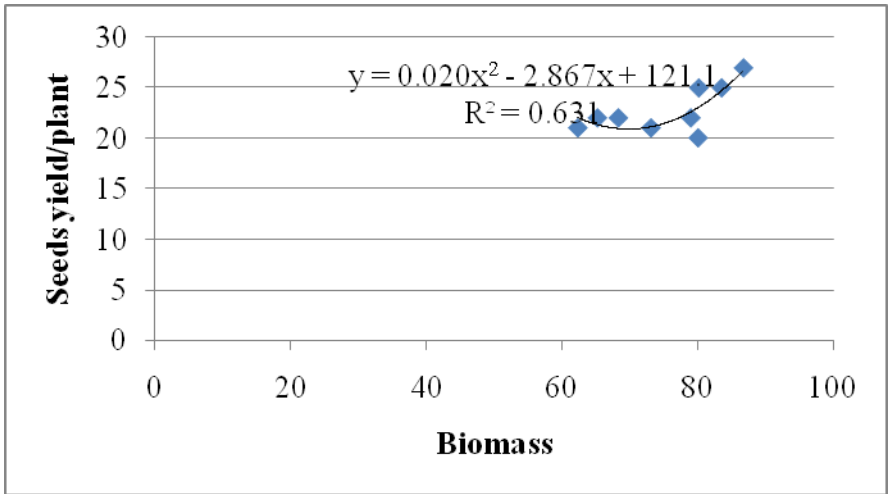

Figure 5: Regression analysis of seeds yield as affected by biomass/plant (g)

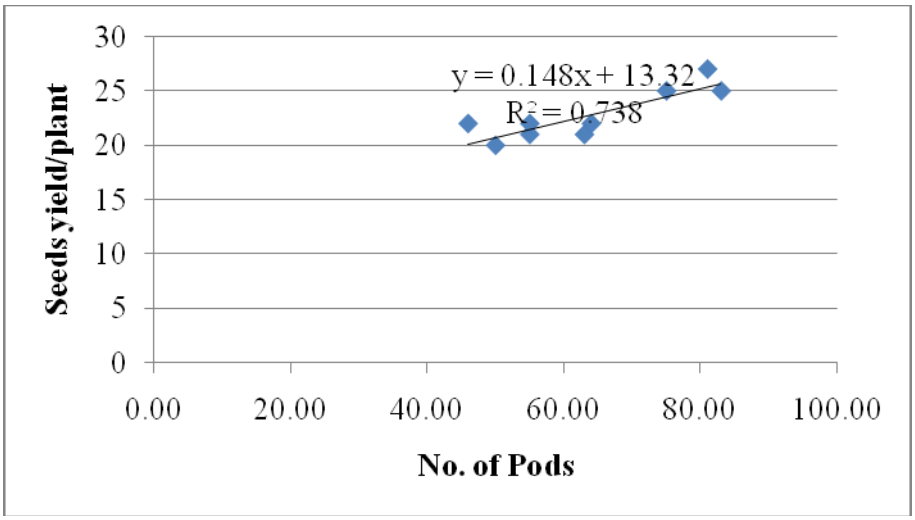

Figure 6: Regression analysis of seeds yield as affected by No. of Pods/plant

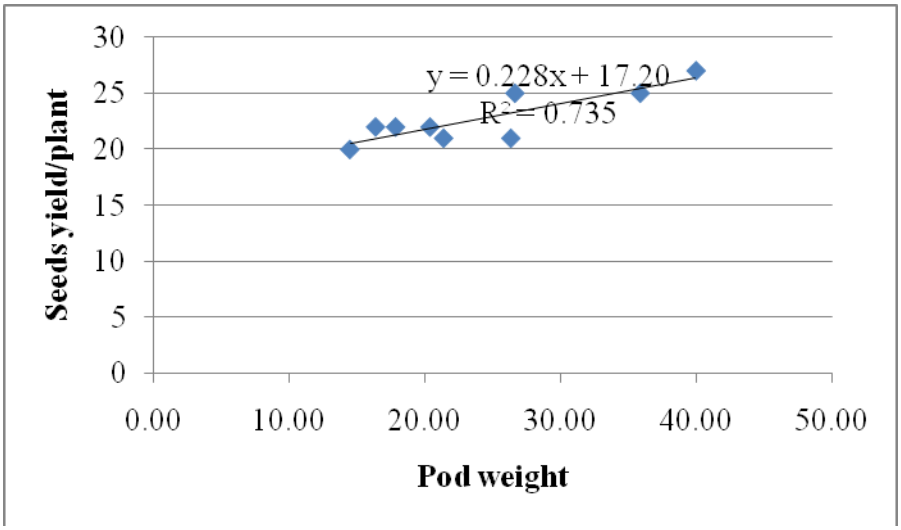

Figure 7: Regression analysis of seeds yield as affected by pod weight (g)

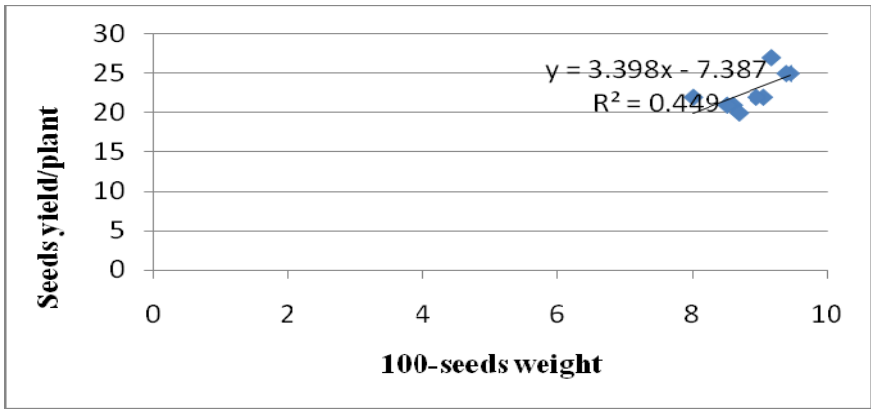

Figure 8: Regression analysis of seeds yield as affected by 100-seeds weight (g).

CONCLUSION

Out of all the varieties studied, soybean variety LV19 performed best with respect to seeds yield and yield contributing traits therefore it is proved to be most suitable for sowing under agro-climatic conditions of Bakrajo. It is followed by soybean varieties LV12. However, soybean varietyLV88 was found to be inferior to all other varieties. All the plant traits, except Plant height positively contributed towards final seeds yield. However maximum contribution was given by number of branches per plant Therefore, these traits should be given top priority when breeding was aimed at selecting superior soybean genotypes. However, minimum contribution was given by plant biomass therefore this trait should be given least importance.

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