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YIELD OF SOYBEAN CULTIVARS AS AFFECTED BY PLANTING DATE UNDER PESHAWAR VALLY CONDITIONS

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Soybean cultivars Epps (MG-V) and Williams 82 (MG-111) were planted on four dates from May to August at one month interval at Malakhandher Farm, Agricultural University Peshawar. The two yields were regressed on date of sowing to quantify the effect of date of sowing on soybean cultivars. A steady decrease in yield was observed as sowing was delayed from May Ist onward. The yield in Epps decreased at the rate of 58.6 $kgha^{-1}$ day^{-1} from May to August and of Williams 82 decreased at the rate of 163.6 $kgha^{-1}$ day^{-1}delay in sowing. On the average Epps produced 4227 $kgha^{-1}$ total dry matter yield, where as Williams 82 produced 3451 $kgha^{-1}$ respectively. Both cultivars gave maximum biological and seed yields in early planting than delay planting. It can be concluded that the two soybean cultivars can be planted during May to avoid drastic reduction in yields under Peshawar valley conditions.

Keywords: Soybean, Planting dates, Biological and seed yields, Environment

1. Introduction

Soybean [Glycine max (L.) Merr] is one of the important oil and protein crop of the world. Jimenez et al. [10] reported that the supplies of oils and protein especially from animal sources (meat and fish) are becoming scarce and expensive particularly in developing nations. As a logical source of oils and proteins, soybean can play a major role in elevating nutritional standards of foods in developing nations, where human beings are facing protein deficiencies [4]. Beg [3] stated that soybean is capable in narrowing the gap between the production and consumption of oils in Pakistan, provided it can be fitted into the cropping pattern. One of the reasons for lesser area, lower yield, smaller returns and nominal production of soybean in Pakistan is the erratic and poor emergence of the crop in the field partly due to poor seedling establishment and due to higher temperature. Seed quality is determined by its viability and vigor, which depends upon the conditions under which the seed has been produced. Appropriate date of sowing is not only important for proper germination and emergence but also to have the crop in the field when environmental conditions are conducive for maximum growth and development as environment has a pronounced effect on the growth and development of plants. Length of photoperiod strongly influences the morphology of soybean plant by causing changes in the time of flowering, maturity and dry matter production. Soybean cultivars do not have the same critical day length. Therefore the effect of planting date on the number of days to flowering, maturity and dry matter production will be different for different cultivars. Average dry matter yields of 1902 $kgha^{-1}$, 10220 $kgha^{-1}$ and 8512 $kgha^{-1}$ [6, 7, 9] have been reported. Significant differences in dry matter accumulation were found between determinate and indeterminate soybean and between soybean isolines [2, 11]. This study was undertaken to determine the influence of different planting dates on biological and seed yields of determinate and indeterminate cultivars under Peshawar valley conditions.

2. Materials and Methods

The effect of planting date on biological and seed yields of soybean cultivars was investigated in a field experiment conducted at Malakhandher Farm, NWFP Agricultural University Peshawar, during 1997 and 1998. The site was located at 34^o N latitude, 71.3^o E longitude and an altitude of 450 meters above sea level and has a continental type of climate. Indeterminate cultivar Williams 82 (MG-III) and determinate cultivar Epps (MG-V) were planted on May 2, June 2, July 2 and August 2

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during both years. The experiment was laid out in a randomized complete block design with split plot arrangement having four replications. Planting dates were allotted to main plots and cultivars to sub plots. The sub plot measures 4m x 5m were established to accommodate 8 rows 50cm apart. Sowing was done in hills and row to row distance of 50 cm and hill to hill distance of 10 cm were used. The soil of the experimental site was silty clay loam with a clay type montmorillonite, low in nitrogen (0.03-0.04%), organic matter (0.8-0.9%) and alkaline in reaction with a pH 8.0-8.2 [12]. A basal dose of 36 kg N and 92 kg P_2O_5 in the form of diammonium phosphate (DAP) fertilizer was applied at sowing. Normal cultural practices for raising a successful crop were followed uniformly for all the experimental units. Irrigation was applied at weekly intervals or as when needed. A net plot size of 5m x 3m was harvested by hand at maturity. The material was air dried and weighed with a spring balance to record biological yield. The bundles were threshed separately, the seed was cleaned, dried and weighed to record seed yield. Data were analyzed statistically according to randomized complete block design with split plot arrangement and LSD test at 0.05 level of probability was used for mean separation. Data were regressed on planting dates to quantify the effect of date of sowing on soybean cultivars.

3. Results and Discussion

3.1. Biological yield

Biological yield was significantly affected by date of planting and cultivars (Table 1). Maximum biological yield was obtained from early planted crop in May, followed by that planted on June 2. Dry matter yield for various planting dates ranged from 7761 to33020 $kgha^{-1}$. Epps produced higher biological yield than Williams 82. Maximum dry matter (34286 $kgha^{-1}$) was obtained from Epps planted on May 2, and minimum (7629 $kgha^{-1}$) from Williams 82 planted on August 2. Seasonal dry matter yield for both cultivars shows that in each cultivar dry matter yield increased when planted between early May and June, attained a peak and then declined. Peak of dry matter was not similar for various planting dates. Decrease in dry matter yield was observed with delay in planting. Dry matter yield progressively decreased as sowing was delayed from first May onward due to short growing season. The dry matter of Epps decreased at the rate of 58.6 $kgha^{-1}$ day^{-1} from May to August and of Williams 82 decreased at the rate of 163.6 $kgha^{-1}$ day^{-1}, delay in sowing, which could be due to different rate of dry matter accumulation among cultivars as reported by Egli [5], Beaver and Cooper [2] who found Corsoy 79 to have a higher seedfill rate than Williams-79 and concluded that this advantage gave Corsoy 79 its higher yield potential. Interaction between planting dates X varieties was significant and though Epps produced heavier seeds than Williams 82 in all planting dates. The percent difference between the two cultivars was maximum (28%) in the second planting date and minimum (11.5%) in the last planting date. This could be due to the differential response of the varieties to variation in photoperiod and temperature. Henderson and Kamprath [9] have reported dry matter accumulation rates from 106 to 379 $kgha^{-1}$ day^{-1} between specific periods. Similarly Hanway and Weber [7] reported daily rates of dry matter accumulation from 88 to149 $kgha^{-1}$ at specific growth stages. Higher daily rates reported were at specific active growth periods, excluding slow growth rates at emergence and near maturity.

Table 1. Biological yield (kg ha^{-1}) of soybean varieties as affected by date of sowing during 1997 and 1998.

Date of Sowing	Epps	Williams 82	Mean
Two years average D x V			
May 2	28640 a	24083 b	26361.50 a
June 2	19864 c	16676 e	18270.00 b
July 2	17524 d	7386 f	12455.00 c
August 2	7147 h	7180 g	7163.50 d
Mean	18293.75 a	13856.25 b	

Table 2. Seed yield (kg/ha) of soybean varieties as affected by date of sowing during 1997 and 1998.

Date of Sowing	Epps	Williams 82	Mean
Two years average D x V			
May 2	5646	7670	6658 a
June 2	3954	3699	3826 b
July 2	1859	1150	1504 c
August 2	482	408	445 d
Mean	2985	3232	

*Means of the same category followed by different letters are significantly different at 0.05 % level of probability using LSD test.

3.2. Seed yield

The seed that represents economic yield is a mixture of embryonic and maternal tissues. The mature seed is influenced by environmental factors such as temperature and photoperiod. Photoperiod has also been reported to influence seed growth rate in soybean. Seed yield as affected by date of planting is shown in Table 2. Seed yield generally decreased with delay in planting and noticeable reduction was observed after May planting. Effects of planting date on yield could be due to changes in plant architecture like low leaf area index, lesser branching, lower number of leaves, lesser plant height in late planted crop. These changes resulted in smaller plants, reduction in branch stem, yield plant^{-1}[13]. Large reduction in branch stem vegetative and reproductive development resulted from late planting. Although Williams 82 gave 257 and 213 kg more yield than Epps, yet this increase was statistically non-significant. It is evident that biological yield played an important role and seed yield closely followed the same pattern of dry matter production. However, cultivars did not follow this pattern. Williams 82 an indeterminate cultivar being the highest seed yielder had the lowest dry matter production than its determinate opponents. This may be attributed to the determinate nature of Epps with profused branching and leaf development. Williams 82 proved to be the most efficient cultivar in converting biomass to economic yield (Harvest index 0.37) than Epps (Harvest index 0.27). These findings are in conformity with those of Egli and Wardlaw [6] who stated that this differential response of different cultivars could be due to variation in photoperiod and temperature or due to their genetic make-up.

4. Conclusions and Recommendations

It is concluded from the present study that early crop planted during the first week of May and June have positively affected the biological and seed yields of soybean than late crop planted in August. It is recommended that soybean should be planted during the first week of May at the rate of 2,00,000 plants ha^{-1} for obtaining better yield.

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