Studies of the effect of water stress on different parameters of growth of the two varieties of Soybean namely PK 416 and Bragg,

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To study the effects of water stress on the two varieties of soybean namely PK 416 and Bragg. Two experiments were designed so as to have an understanding of the effect of stage and duration of the water stress on vegetative and reproductive growth of the plants. These two experiments will also give an idea as to the mechanism by which the two varieties face drought. One experiment was carried out in open field under natural conditions and the soil from the nearby field was taken which was regularly used for other crops such as paddy and wheat. The plants were grown in pots with 6 L capacity. The experimental design was randomized entirely factorial, with 2 hydric conditions (stress and control and 4 stress points (0, 2, 4 and 6 days). The experiment comprised of 8 repetitions and 64 experimental units. Each repetition had one plant.

Introduction

A field experiment was conducted at Shakti nagar on Bye pass Road Chapra Saran Bihar. There were eight treatments and experiment was laid out in randomized block design with three replications. The objective of the present investigation is the identification of the stage or stages of development in which soybean is most sensitive to drought in this sub humid condition of Bihar. **PK 416-**It requires 115 to 120 days for maturity, it is grown generally in Northern hill & northern plain zones. It is resistant to YMV & bacterial pustules, tolerant to Rhizoctonia. It is characterized by White flowers, tawny pubescence, yellow seed coat, brown hilum and semi-determinate nature. **Bragg-** It requires 112-115 days for maturity and can be grown throughout India. It is resistant to bacterial pustules but susceptible to yellow mosaic virus. It is characterized by White flowers, grey pubescence, yellow seed coat, black hilum, brown pods and determinate nature.

Experiment design and treatment:

The experimental design was randomized entirely factorial, with 2 hydric conditions (stress and control) and 4 stress points (0, 2, 4 and 6 days). The experiment comprised of 8 repetitions and 64 experimental units. Each repetition had one plant.

Three seeds were placed into each pot and after 7 days, the plants were thinned to one per pot only. The plants were watered daily and received macro and micronutrients every 5 days, using the nutritive solution of Hoagland and Arnon (1950) for 40 days. Starting 40th day after the implementation of the experiment, the plants from the treatment under stress were submitted to the period of 6 days without irrigation, simulating the water stress until the 46th day. After this period the plants were taken away to the laboratory for measuring the morphological parameters.

Measurements :

The height of the plant was measured and number of leaves were counted. Leaf Relative Water Content (LRWC) was calculated with 10mm disks in diameter. It was calculated by the formula- LRWC = [(FW- DW)/TW-DW)] × 100, where

FW is the fresh weigh, TW is the turgid weight measured after 24 h of staturation on deionised water and DW is the dry weight determined after 48 h in an 80^{o}C as recommended by (Slavick, 1979).

It was carried out after the washing of the root with distilled water and drying it by placing in between filter papers. The plants were divided into shoot and root before the weight and measurements were taken. The number of filled and unfilled pods and number of seed per pod were counted. Good seeds were collected from dried and shelled pods and weighed to represent seed yield. The 1,000-grain weight (g) was determined from the same samples. A field experiment was conducted at Shakti nagar on Bye pass Road Chapra. There were eight treatments and experiment was laid out in randomized block design with three replications. The objective of the present investigation is the identification of the stage or stages of development in which soybean is most sensitive to drought in this sub humid condition of Bihar.

Results & Discussions

Table - 1

Effect of progressive water stress on different morphological parameters of the two varieties of soybean :-

Parameters /variety	LRWC (%)	Height(cm)	No. of leaves	Shoot dry wt.(g)	Root dry wt. (g)
PK 416 Control					
0h	82.5	45	5.75	0.72	0.22
0h	84	54	7	0.78	0.27
4h	83	60	7.2	1.12	0.28
6h	82	72	8.5	1.45	0.36
Stressed					
Oh	82.5	45	5.75	0.72	0.22
2h	73	49	7	0.75	0.24
4h	66	52	6.9	0.95	0.29
6h	62	57	7	1.32	0.48

Parameters/variety	LRWC (%)	Height(cm)	No. of leaves	Shoot Dry wt.(g)	Root Dry wt.(g)
Bragg Control					
0h	84	54	6	0.84	0.35
2h	85	62	7.5	0.95	0.45
4h	85	70	8	1.30	0.48
6h	83	75	9.5	1.80	0.52
Stressed					
Oh	84	54	6	0.84	0.35
2h	71	58	7.2	0.92	0.42
4h	62	62	7.2	1.12	0.47
60	60	65	7.2	1.42	0.61

The results obtained in the experiment studying the effect of progressive water stress on the Leaf Relative water content, plant height, number of leaves, shoot dry matter and root dry matter has been presented in Table – 1. LRWC in control and stressed condition varies significantly in both the varieties.

The variation in control is little between the periods of measurements in both the varieties as it varied between 82- 84 in case of PK 416 where as between 83-85 in case of Bragg which suggests that the two varieties do not differ significantly with respect to LRWC in controlled condition of no stress. In stressed condition the variation in case of PK 416 is between 62-82.5, where as in case of Bragg this is between 60-84, thus variation in Bragg is more pronounced than PK 416.

The response of the two varieties with respect to height of the plant in stressed condition shown in theTable-1. Shows that in case of PK 416 the difference in height that is increase in height, is about 27 cm during the period of observation in control where as in stressed condition it is only 12 cm. In case of Bragg variety the increase in control, that is non-stressed condition, is 21 cm during period of observation where as in stressed condition it is only 11cm. Increase in height vary much between the two varieties as in PK 416 the total increase in height under control is 60% where as in stressed condition it is only 26.6%. If each stress period is considered separately it is 20%, 11.1%, 20% in the period from 0 to 2, 2 to 4 and 4 to 6 days in control. This value is 8.8%, 6.1%, 9.6% for the same time intervals in stressed condition. Thus it is clear that percentage increase as a whole in control and stressed condition is 60% and 26%.

In case of Bragg, the overall increase in height is 38.8% in control where as only 20.3% in stressed condition. If the three different stress periods are taken into consideration the increase is 14.8%, 12.9% and 7.1% respectively in periods 0-2 days, 2-4 days and 4 – 6 days stress respectively, where as in stressed Condition the above values are 7.4, 6.9 and 4.8 respectively.

No. of Leaves – In case of No of leaves the data for the two varieties shows that the overall increase in the no. of leaves is 30.4% in control and 21.7% in stressed condition in case of PK 416 where as in case of Bragg variety it is 58.3% and 20.4% respectively for similar condition.

In this case also if we study stage to stage increase then it appears that in case of PK 416 mean No. of leaves increased from 5.75 to 8.5 in control where as this increase is from 5.75 to 7 only in stressed condition. However, the actual position becomes clear when stage to stage change is considered, the increase is 21.7% in 0-2 days, negative 1.4%, in 2-4 days and 1.4% in 4.6 days stress.

In case of Bragg, in the initial period i.e. 0-2 days stress the increase is 20% but later on in next two stages the increase is zero.

Shoot dry matter:- In case of PK-416 the overall increase in control is 101.4% and in stressed condition this increase is 55.5% only. If stage to stage increase is considered, in control condition it is 8.3%, 43.6% and 29.5% in 0-2, 2-4 and 4-6 days of stress, where as in stressed condition these values are 4.1%, 26.6% and 33.3% respectively.

In case of Bragg variety this increase is 114.2% in control condition where as only 53.1% in stressed condition. If this total increase is partitioned into different duration of study the values for 0-2 days, 2-4 days and 4-6 days are 13.1, 36.8 and 88.4 respectively in control and 9.5%, 21.7% and 28.5% in stressed condition.

Root dry matter-

The result for increase in root dry matter is different from other morphological parts in the sense that this is the only morphological part in which the increase is more pronounced in stressed condition than control condition. In case of PK-416 variety, the overall increase in control condition is 83.6% where as is stressed condition in is 113%. Similar is the condition in Bragg variety where the increase is 48.5 in control and 74.2% in stressed.

Here also if the stage wise increase is considered, the increase in 0-2, 2-4 and 4-6 days stress it is 22.7%, 3.7% and 28.5% in control and 9.6%, 20% and 65.5% in stressed condition in case of PK-416. These values for Bragg variety are 42.8%, 6.25, 8.33%, and 20%, 11.9% and 29.7% respectively.

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