Evaluation of 'SOYGRO' model for soybean crop under Hisar conditions*

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ABSTRACT

Field experiment was carried out at Research Farm of Department of Agricultural Meteorology, CCS Haryana Agricultural University, Hisar located during *rabi* season of 2006 and 2007 on a sandy loam soil to study the evaluation of SOYGRO model of PK- 416 soybean cultivar for Hisar conditions. Yield attributes like pods per plant, number of seeds per pod and 100-seed weight decreased with subsequent delay in sowing from 7 June onward during both the seasons. Seed yield, straw yield and biological yield were highest in 7 June sowing as compared to late sown. The predicted deviation of seeds per pod was underestimated during both the crop seasons. This deviation varied from -4.47 to -8.95 seeds per pod in 2006 and -5.12 to -8.15 seeds per pod in 2007. The comparison of observed and simulated yield parameters viz., seed and straw yield showed that the model overestimated under all sowing dates. The straw yield was mostly overestimated but it was underestimated when crop sown delayed.

Key words : Observed and simulated, soybean, SOYGRO model, yield attributes

Soybean [*Glycine max* (L.) Merr.] has emerged as the third important oilseed crop next to groundnut and rapeseed-mustard in India. Soybean, being a photo- and thermo-sensitive short day C_3 plant, influences to considerable extent the area of its adoption and time of maturity. The environment, a crop is likely to encounter during its growth and development, can be manipulated by various management practices such as time of sowing and selection of cultivars. Crop models are available for almost all economically important crops and have the ability to predict yield and evaluate different options to maximize profit and/or minimize losses of nutrients or chemicals by integrating the effects of daily weather data with soil characteristics and management practices (Boote *et al.*, 1998). SOYGRO is a generic photosynthesis process oriented legume crop model. The major components of the SOYGRO-soybean model are the vegetative and reproductive development of crop. Evaluation of widely adopted and used SOYGRO model seeks the possibility for its applications under Hisar conditions for its adoption. Such models, if properly validated and evaluated, can invariably prove a useful tool, not only to predict the yield potential and pricing of the crop, but also aid farmers in determining the environmental factors that limit crop yield under local conditions.

MATERIALS AND METHODS

A field experiment was conducted at Hisar (29°10′ N latitude, 75°46′ E longitude and altitude of 215.2 m above mean sea level), with PK 416 soybean cultivar under three dates of sowing (1st week of June, 3rd week of June and 1st week of July) during the *kharif* 2006 and 2007 on a sandy loam soil. The experiment was laid out in randomized block design with four replications. The basal doses of nitrogen (25 kg ha^{-1}) and phosphorus (80 kg ha^{-1}) were applied before sowing and all other crop managements were done as per university package of practices. Different weather parameters for running the model were collected from Agromet Observatory of the department. The growth parameters and yield and yield attributes were collected from both the seasons to study the possibility for its applications under Hisar conditions for its adoption.

RESULTS AND DISCUSSION

The yield and yield attributes of soybean cultivar (PK-416) under different dates of sowing were significantly different (Table 1). Yield attributes like pods per plant, number of seeds per pod and 100-seed weight decreased with subsequent delay in sowing from 7 June onward during both the seasons. Seed yield, straw yield and biological yield were highest in 7 June sowing as compared to late sown. Similar findings were observed by Singh and Hundal (2004), Neog *et al.* (2008) and Egli and Cornelius (2009). Seed and straw yields were higher during 2007 as compared to 2006.

The accuracy of final yield predictions depends on timely predictions of critical growth stages beginning with emergence. However, predicting soybean phenology is difficult because of lack of understanding of sensitivity to temperature and photoperiod during development (Grimm *et al.*, 1994). The results presented in Table 2 show the comparison of observed and

Table 1: Yield and yield attributes of soybean cultivar (PK-416) under different growing environments during 2006 and 2007

Treatments	Pods/ plant	Seeds/ pod	100-seed weight (g)	Seed yield (q ha⁻¹)	Straw yield yield (q ha⁻¹)	Biological (q ha⁻¹)	HI (%)
2006							
1st week of June	110.6	2.57	12.57	23.81	50.88	74.69	31.8
3rd week of June	100.1	2.36	11.45	22.16	51.28	73.44	30.2
1st week of July	92.3	2.19	11.15	19.37	46.49	65.86	29.4
C. D. (P=0.05)	NS	NS	0.63	2.01	NS	5.06	-
2007							
1st week of June	114.8	2.22	15.15	33.18	65.72	98.91	33.55
3rd week of June	109.7	2.13	13.81	30.31	61.56	31.88	32.99
1st week of July	107.4	2.07	12.92	29.41	60.66	90.07	32.65
C. D. (P=0.05)	NS	NS	0.70	1.7	NS	0.8	NS

Table 2: Comparison of observed and predicted yield parameters in soybean under different environments during 2006 and 2007

Treatments	Seeds/pod			Seed yield(q ha⁻¹)			Straw yield (q ha⁻¹)		
	O	P	D	O	P	D	O	P	D
2006									
1st week of June	2.57	2.46	-4.47	23.81	24.38	2.33	50.88	51.03	0.29
3rd week of June	2.36	2.25	-4.48	22.16	23.05	3.86	51.28	50.84	-0.86
1st week of July	2.19	2.01	-8.95	19.37	19.95	2.90	46.46	47.01	1.06
2007									
1st week of June	2.22	2.11	-5.26	33.19	33.78	1.74	65.72	66.03	0.46
3rd week of June	2.13	2.03	-5.12	30.13	31.03	2.31	61.57	62.1	0.86
1st week of July	2.07	1.91	-8.15	29.41	30.82	4.5	60.66	59.74	-1.53

O–Observed, P–Predicted, D–% Deviation.

simulated yield parameters viz., seeds per pod, seed and straw yields of soybean. The predicted deviation of seeds per pod was underestimated during both the crop seasons. This deviation varied from -4.47 to -8.95 seeds per pod in 2006 and -5.12 to -8.15 seeds per pod in 2007. The model predicted overestimation for seed and straw yields and predicted that seed and straw yields were highest for 1st week of June during both the growing seasons. The comparison of observed and simulated yield parameters viz., seed and straw yield showed that the model was overestimated under all sowing dates. Similar results were found by Pedersen *et al*. (2004) and Kaur *et al*. (2004). The straw yield was mostly overestimated but it was underestimated when crop sown delayed. This model was within the acceptable limits for Hisar conditions for the prediction of yield and yield attributes of soybean crop.

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