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RESEARCH PAPER

Influence of Cattle Breeds-Specific Bio-Formulations on Soybean Phenology

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ABSTRACT

The present experiment was conducted during the *kharif* season of 2022 and 2023 at Zero Budget Natural Farm (ZBNF), Department of Organic Agriculture and Natural Farming, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The soil of the experimental field was silty clay loam, slightly acidic in nature (5.76), low in available nitrogen (230.5 kg/ha) and medium in available phosphorus (15.8 kg/ha) and potassium (220.6 kg/ha). The experiment was laid out in RBD design with 3 replications *viz.* bio-formulations prepared with inputs of seven different cattle breed *viz* Indigenous cow (*Pahari)* lactating, Indigenous cow (*Pahari)* dry, Indigenous cow (Sahiwal) lactating, Indigenous cow (Sahiwal) dry, Exotic cow (Jersey) lactating, Exotic cow (Jersey) dry, Indigenous bull (*Pahari).* Results showed that the application of bio-formulations prepared from inputs of Indigenous cow (*Pahari*) dry resulted in the least days to initiation of first floral bud, days to initiation of first flower, days to initiation of first pod and days to first pod maturity.

HIGHLIGHTS

- The soybean [*Glycine max* (L.) Merr.] is grown worldwide for its high protein and oil content. Trends in soybean phenology Influence of Cattle Breeds-Specific Bio-Formulations were examined.
- Earliness of soybeans can help the crop take full advantage of the warm growing season, especially in regions with a shorter growing season. This ensures that the soybeans grow and mature under optimal conditions.

Keywords: Natural farming, bio-formulations, soybean

Soybean (*Glycine max*) is a pivotal crop in global agriculture, known for its high nutritional value and versatility (Mishra *et al.* 2024). Native to East Asia, it has become a staple in various industries due to its rich protein content and diverse applications soybean is not only a cornerstone of plant-based diets, providing essential amino acids, fiber, and vitamins, but also a major source of vegetable oil and animal feed (Kumar *et al.* 2008). Its ability to fix atmospheric nitrogen enriches soil health, making it a crucial component in sustainable farming practices. As the demand for sustainable and efficient agricultural practices grows, understanding soybean cultivation, including its phenological stages and the impact of different farming methods, remains essential for optimizing yields and advancing agricultural sustainability (Debnath *et al.* 2020). Natural farming, an agricultural approach that emphasizes minimal intervention, the use of organic inputs, and the promotion of ecological

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balance, has garnered significant attention for its potential impact on crop production and ecosystem health (Gamage *et al.* 2023). When examining its effects on the phenological studies of soybeans, several key aspects come into play. Phenology, the study of periodic biological events in relation to environmental conditions, is crucial in understanding how plants like soybeans respond to changes in their environment (Staniak *et al.* 2023). Natural farming techniques such as the use of cover crops, various bio-formulations, and reduced soil disturbance can profoundly affect soybean phenology. These practices might alter soil structure and nutrient availability, which in turn can influence the timing and duration of key phenological stages. The objective of the research was to study the effect of bio-formulation prepared from the input of different cattle breeds on the earliness of soybeans.

MATERIALS AND METHODS

Description of the study area

The present experiment was conducted during the *kharif* season of 2022 and 2023 at Zero Budget Natural Farm (ZBNF), Department of Organic Agriculture and Natural Farming, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The experimental site lies in Palampur valley of district Kangra, Himachal Pradesh between 32°6′ N latitude, 76°3′ E longitude perched in the lap of majestic snow-clad Dhauladhar range of North Western Himalayas at an elevation of 1290.8 meter above mean sea level (amsl).

Description of climatic conditions

The site represents the mid hills sub-humid zone of Himachal Pradesh. This zone extends from 651 meters to 1800 meters amsl, having mild temperate climate and occupies about 32 per cent of the total geographical area and 37 per cent of the cultivated area of the state**.**

Treatments and experimental design

The experiment was laid out in RBD design with three replications. Bio-formulations prepared with inputs of seven different cattle breed *viz.*, Indigenous cow (*Pahari)* lactating, Indigenous cow *(Pahari)* dry, Indigenous cow (Sahiwal) lactating, Indigenous cow (Sahiwal) dry, Exotic cow (Jersey) lactating, Exotic cow (Jersey) dry and Indigenous bull (*Pahari).* The necessary ingredients for making *ghanjeevamrit, beejamrit and jeevamrit* were procured, then inputs were prepared using the dung, and urine from different cattle breeds. The data on various characters were statistically analyzed as suggested by Gomez and Gomez (1984). Wherever statistical significance was observed critical difference (CD) @P=0.05% level of probability was worked out for comparison of mean data.

RESULTS AND DISCUSSION

Days to initiation of first floral bud

An inspection of data related to days to initiation of first floral bud (Table 1) revealed that the application of bio-formulations prepared from the inputs of exotic cow (Jersey) lactating resulted in significantly higher number of days to initiation of first floral bud as compared to other treatments during both the years of experimentation. However, it was found to be at par with exotic cow (Jersey) dry during *kharif* 2023. The least number of days taken to initiation of first flower bud was recorded in the application of bio-formulations prepared from the inputs of cow Indigenous *(Pahari)* dry. Application of different natural farming inputs increase the population of microbes. These microbes may have played a critical role in providing essential plant nutrients to the crop resulting in. Balpande *et al.* (2013) reported an increase in the population of bacteria, fungi and actinomycetes with application of various bio-formulations.

Days to initiation of first flower

Days to initiation of first flower was significantly affected by the application of bio-formulations prepared from the inputs of different cattle breeds. A significantly higher number of days to initiation of first flower were recorded by the application of bio-formulations prepared from the inputs of exotic cow (Jersey) lactating. However, it was found to be at par with Indigenous cow (Sahiwal) lactating, Indigenous cow (Sahiwal) dry, and Exotic cow (Jersey) dry during *kharif* 2022. During, *kharif* 2023 it was found to be at par with Indigenous cow (Sahiwal) dry, Exotic cow (Jersey) dry. Least number of days to initiation of first flower was recorded by

Table 1: Effect of bio-formulations prepared from different cattle breeds on phenological studies of soybean

Bio- formulations prepared from	Days to initiation of first floral bud		Days to initiation of first flower		Days to initiation of first pod		Days to first pod maturity	
	2022	2023	2022	2023	2022	2023	2022	2023
T_1 Indigenous cow (*Pahari*) lactating	53.8	50.2	64.8	62.4	94.9	90.4	114.8	112.6
T_2 Indigenous cow (*Pahari*) dry	52.1	49.1	63.7	60.4	92.6	89.6	112.6	109.4
T_3 Indigenous cow (Sahiwal) lactating	56.8	55.0	69.1	66.4	96.2	94.2	118.7	115.9
T_4 Indigenous cow (Sahiwal) dry	55.8	53.4	67.4	65.2	95.8	94.8	117.6	115.1
T_5 Exotic cow (Jersey) lactating	61.4	59.3	71.2	70.1	98.1	97.5	121.7	119.8
T_6 Exotic cow (Jersey) dry	58.9	56.5	69.8	68.45	98.8	96.6	120.9	118.3
T_7 Indigenous bull (*Pahari*)	54.3	52.9	66.4	63.4	94.1	93.6	115.8	113.5
SE(m) ±	0.80	0.79	1.51	1.23	2.14	2.41	1.61	2.91
LSD (P=0.05)	2.51	2.48	4.71	3.85	NS	NS	5.03	NS

application of bio-formulations prepared from the inputs of cow Indigenous *Pahari* dry.

Days to initiation of first pod

No significant difference was observed by the application of formulations prepared from the inputs of different cattle breeds on days to initiation of first pod. However, the highest number of days to initiation of first pod was observed by application of bio-formulations prepared from the inputs of exotic cow (Jersey) lactating during both the years of experimentation, and the least number of days to initiation of first pod was recorded by application of bio-formulations prepared from the inputs of cow Indigenous *Pahari* dry.

Days to first pod maturity

The effect of bio-formulations prepared from the inputs of different cattle breeds was significant during *kharif* 2022. Significantly higher Days to first pod maturity were observed by the application of bio-formulations prepared from the inputs of exotic cow (Jersey) lactating. The least number of days to first pod maturity were recorded by application of bio-formulations prepared from the inputs of cow Indigenous *(Pahari)* dry resulting in early harvest of the crop.

CONCLUSION

Bio-formulations prepared from the inputs of Indigenous *(Pahari)* dry resulted in the least days to initiation of first floral bud, days to initiation of first flower, days to initiation of first pod and days to first pod maturity. This early harvest can be particularly advantageous in regions with shorter growing seasons or where climatic conditions are unpredictable, helping to mitigate the risk of crop damage from late-season frost or extreme weather events.

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