MAXIMIZE SOYBEAN PRODUCTIVITY THROUGH HIGH-YIELDING PEST-RESISTANT VARIETIES AND LAND MANAGEMENT PRACTICES

VASUDEV MEENA[1]*, M L DOTANIYA[2], B P MEENA[1], H DAS[1] and J K SAHA[1]
[1]ICAR-Indian Institute of Soil Science, Bhopal, Madhya Pradesh
[2]ICAR-Directorate of Rapeseed-Mustard Research, Bharatpur, Rajasthan
*Corresponding author, E-mail: vasu_maheshin84@rediffmail.com

Madhya Pradesh and Maharashtra contribute 89 per cent of total soybean production in India. Rajasthan, Andhra Pradesh, Karnataka, Chhattisgarh and Gujarat contribute the remaining 11 percent production. The estimates from Soybean Processors' Association of India (SOPA) showed that India's soybean output was 8.36 million tonnes from 10.16 million ha in 2017-18, about 24 per cent lower than 10.9 million tonnes of 2016-17. Madhya Pradesh is popularly known as the "Soybean State" of India. Soybean covers about 40 percent of the net sown area in Madhya Pradesh (5.41 million ha) which accounts for 55-60 percent of the soybean produced in India with 5.92 million tonnes of soybean output. However, soybean yield has declined rapidly in the state in the past few years due to erratic rainfall pattern, increasing pest and disease incidences and mono-cropping. That makes the cultivation of soybean uneconomical for the farmers and soybean area has been converted to urd, maize, redgram, sorghum and paddy. In fact, in the high production of soybean selection of a high yielding variety that is ideal to withstand the biotic and abiotic stresses in the farmland play a major role. There is no doubt that selection of soybean variety directly affects the yield potential and farm income as each variety has specific strengths that can make it highly suited for a certain environment but less suited for another.

The decision farmer makes in variety selection also affects crop management decisions of the crop season like amount of fertilizers, herbicide, and plant protection chemicals need to be used to attain maximum possible crop yield for a reasonable net farm income. For example, if a field has a history of particular disease or pest infestation, selection of a resistant variety that can manage those specific problems not only minimises biotic stresses but also reduces use of plant protection chemicals. Moreover, selection of high yielding varieties has direct affect on crop productivity as yield differences between varieties reported to be a maximum of 25 percent in replicated varietal trials.

Figure 1. JS 9560 (released by JNKVV Jabalpur) in the farmer fields of Bhopal district in Madhya Pradesh

Agriculture research institutions of India developed a number of high yielding soybean varieties ideal for various locations of the soybean belt of India (figure 1). Most of those high yielding varieties are usually a combination of two or more advantageous traits such as higher crop yield per hectare, more responsive to fertilizers, resistant to insect pest and diseases, dwarf nature and early maturing, improved quality of crops and high reliance on irrigation etc. in contrast to local varieties. Some varieties ideal for the soil and climatic conditions of Madhya Pradesh are given in table 1.

Table 1 Varietal Characteristics of Soybean Suitable for Madhya Pradesh

Varieties	Yield (q/ha)	Duration (Days)	100 Seed Wt (g)	Growth Characteristics	Special Characteristics
RVS 2001-4	20-25	91-93	13	Plant height 50-60cm, 3-4 branches, Strong root system and leaf-light green, hairy, Flowers white colour, seed dark yellow colour 15% more production than other varieties like JS 95-60, JS 93-05, JS 335 Protein 42% and Oil 21.5%	Withstand to drought and pounded water (excess water) Resistant to yellow mosaic, semi-looper, girdle beetle and root rot etc.
JS-335	25-30	95-100	10-13	Purple flowers, semi-determinate, resistant to shattering, black hilum. Performs well in Eastern and Southern states.	Resistant to bacterial pustule, bacterial blight and tolerant to green mosaic, susceptible to YMV.
JS 93-05	20-25	90-95	13	Semi determinate, violet flowers, lanceolate leaves, four seeded pods, glabrous stem & pods, non-shattering, black hilum.	Resistant to major diseases and insect pests.
JS 95-60	20-25	80-85	>13	Semi dwarf, Plant height 45-50 cm, purple flower, No shattering of pods	Resistant to bacterial pustule, bacterial blight, charcoal rot, YMV
JS 97-52	25-30	100-110	12-13	White flower, yellow seed.	Resistant to disease and insect, suitable for high humid/moisture area
JS 20-34	22-25	87-88	12-13	Medium duration, White flower, yellow seed.	Resistant to bacterial pustule, bacterial blight, charcoal rot, suitable for low rainfall area
JS 20-29	25-30	90-95	>13	White flower, yellow seed.	Resistant to bacterial pustule, bacterial blight, charcoal rot, YMV
Ahilya-1 (NRC 2)	25-30	103-106	>13	White flowers, tawny pubescence, yellow seed coat, grey to black hilum, good germination, determinate.	Resistant to Rhizoctonia, pod blight, green mosaic virus, bacterial blight and tolerant to Cercospora leaf spot and Anthracnose
Ahilya-3 (NRC 7)	25-35	90-99	>13	Determinate, grey pubescence, purple flowers, yellow seed coat, brown	Resistant to bacterial blight, green mosaic virus, bacterial pustules, phyllody, soybean mosaic,

				hilum, high oil content, resistant to pod-shattering.	Myrothecium and Cercospora leaf spots, tolerant to stem fly, girdle beetle, green and grey semi looper, leaf miner and defoliators.
NRC 37 (Ahilya 4)	35-40	96-102	>13	Erect, determinate plants without anthocyanin colouration in the hypocotyl, white flowers, tawny pubescence, small to medium, and spherical yellow seeds with light to dark brown hilum.	Moderately resistant to collar rot, bacterial pustule, pod blight and bud blight like syndrome. Moderately resistant to stem fly and leaf miner. Non lodging under optimum plant population, non shattering behaviour up to 10 days after harvest maturity
NRC-12	25-30	96-99	>13	Medium duration, semi-determinate, purple flower.	Tolerant to girdle beetle, stem fly and resistant to YMV
NRC-86	20-25	90-95	13	White flower, brown pod, determinate type.	Resistant to girdle beetle, stem fly and medium resistant to charcol rot and anthracnose
JS 2	18-20	90-95	11-12	Purple flowers, tawny pubescence, pods with dense brown pubescence, yellow seed coat, light brown hilum, determinate, highly shattering.	Resistant to bacterial pustule, tolerant to Macrophomina

LAND MANAGEMENT PRACTICES TO BOOST GRAIN YIELD

In land management practices, soil moisture conservation techniques like ridge tillage (RT) and broad bed furrow (BBF) system (figure 2) increases microbial biomass, enzyme activities, nutrient uptake and particulate organic carbon in soil that in turn increases soybean seed yield as compared to flat bed planting under soybean-wheat system.

Figure 2. Cultivation of soybean crop using BBF technology in farmer fields of Madhya Pradesh

Also, BBF and RT along with FYM and fertilizer application improve soybean productivity. Studies reported that C sequestration (soil organic carbon, particulate organic carbon, light fraction carbon and soil organic carbon stock) was higher in fields with moisture conservation strategies as compared to flat bed planting.

CONCLUSION

Each variety has some specific genomic character that directly affects the yield potential and farm income because of their suitability or unsuitability to a particular growing environment. Variety selection is considered as most important management decisions that influence soybean production and productivity. Hence, care should be taken while selecting the variety for cultivation of soybean for getting higher yield and income according to the suitability of the variety in this particular region.

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