

Permanent broad bed furrow technology

for soybean-based cropping systems

Rakesh Kumar Verma^{1*}, Raghavendra Nargund¹ and K H Singh¹

¹ICAR-Indian Institute of Soybean Research, Indore 452 001, Madhya Pradesh

Soybean is a leading oilseed crop in India and the world. Currently, national soybean productivity is 1.1 t/ha, compared to world productivity of 2.8 t/ha. Low productivity is mainly attributed to abiotic stresses (drought and flood during the cropping period), biotic stresses (insect pests and diseases), and traditional management practices. Therefore, to counteract abiotic stresses and enhance soybean productivity, a long-term (2017-2023) experiment on Permanent Broad Bed Furrow (PBBF) under soybean-based cropping systems was conducted at the ICAR-Indian Institute of Soybean Research, Indore. Significantly higher yield of kharif and rabi crops, system productivity (27.4%), highest net returns (₹ 311192/ha), and increased benefit cost ratio (4.53) were observed under PBBF + residue (R) retention as compared to conventional tillage as per farmer's practices. Similarly, among cropping systems, soybean-potato-late sown wheat reported the highest system productivity (11.5 t/ha), net returns (₹ 418841/ha), and B: C ratio (4.28). The available nutrients, soil organic carbon, and microbial parameters increased under soybean-potato-late wheat under the PBBF + R crop establishment method. Therefore, adopting a soybean-potato-late wheat cropping system under PBBF+R would be more remunerative for farmers in the Malwa region of central India.

Keywords: Available nutrients status, Land configurations, Residue management, Soybean-Potato-Wheat, Yield

Soybean is a principal oilseed crop, contributing around 42.06% to the total oilseed area and 34.45% to the total oilseed production in the country (DE&S 2022). Soybean-wheat is one of the leading (being cultivated in a 4.5-million-hectare area) cropping systems in the Malwa region in central India under a rainfed ecosystem. Conversely, farmers are also taking Soybean-Potato-late sown wheat cropping system with traditional way in the region, where assured irrigation facilities are available. In recent years, serious concerns have been raised on yield decline in soybean-based cropping systems mainly due to conventional tillage, abiotic stresses (flood and drought), multi-nutrient deficiency, wheat crop residue burning, and faulty management practices. Therefore, keeping in view, experiment

was designed to study the effect of different crop establishment methods/land configuration and cropping systems on yield, system productivity, economics, and soil health under soybean-based cropping systems.

About PBBF technology under soybean-based cropping systems

The long-term field experiment was initiated in the year 2017 at ICAR-Indian Institute of Soybean Research, Indore Madhya Pradesh, India. Permanent broad bed furrow cultivation practices with or without crop residue retention were tested for seven years (2017-2023) on deep black soil. The *kharif* crop (soybean) residue retained @ 1.0 t/ha to *winter (rabi)* season crops. Further, winter (*rabi*) season crops such as wheat (2.5t/ha) and chickpea (1.0 t/ha) residue retained

to *rainy /kharif* season crop (soybean) in the respective treatments. The plot size of 21.6 m² was maintained in each treatment. The current study compared only the best treatments i.e. Permanent broad bed furrow plus residue (PBBF + R) with conventional tillage as per farmer's practices without residues (CTFP + WR) under three major cropping systems of Malwa region (soybean-wheat, soybean-chickpea, and soybean-potato-late wheat). Soybean (NRC 150), Potato (Kufri Joyti), normal wheat (HI 1544), and late wheat (HI 1634) were sown directly at 45 × 05-10 cm, 45 × 15 cm, and 22.5 cm, respectively with the help of broad bed furrow machine understanding residue. Seed rate for soybean 65 kg/ha, potato (1.5t/ha), and wheat both normal and late sown (100kg/ha) were used. The recommended dose of fertilizers and



Overview of PBBF crop establishment method under soybean-based cropping systems (Soybean-Potato-Late wheat; Cultivars: NRC 150-Kufri Joyti-HI 1634)

Table 1. Effect of cropping systems and crop establishment methods on system productivity and economics under soybean based cropping systems

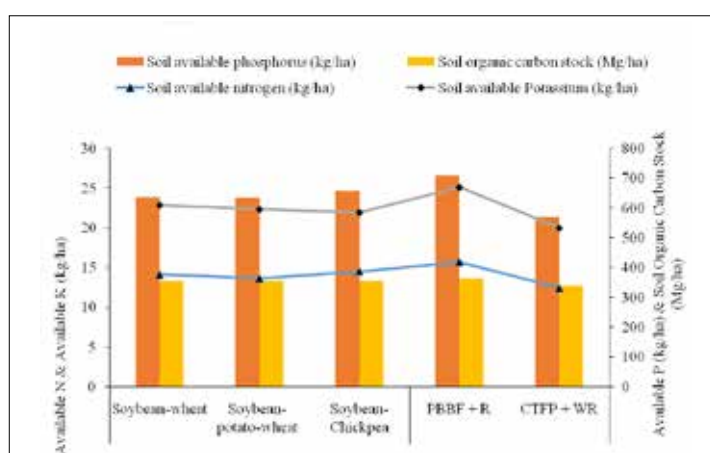
Cropping system (CS)/Land configuration (LC)	Soybean seed yield (q/ha)	Timely sown wheat yield (q/ha)	Chickpea yield (q/ha)	Potato yield (q/ha)	Late sown wheat (after potato) yield (q/ha)	System productivity (t/ha)	System Net returns (₹)	System B: C ratio
<i>Cropping system (CS)</i>								
S-P-W	30.6	-	-	167.0	66.4	11.53	418841	4.28
S-C	31.1	-	13.20	-	-	4.76	161672	3.60
S-W	29.1	58.12	-	-	-	5.60	206633	4.18
<i>Crop establishment methods/Land configuration (LC)</i>								
PBBF + R	32.4	59.6	14.46	225.3	72.0	8.28	311192	4.53
CTFP + WR	27.5	56.7	10.26	132.7	62.1	6.50	223980	3.61

(S-P-W: Soybean-Potato-Late sown wheat, S-C: Soybean-chickpea, S-W: Soybean-wheat, B:C: Benefit cost ratio. PBBF+R: Permanent broad bed furrow with residue retention and CTFP+ WR: Conventional tillage as per farmer's practices without residue retention)

standard agronomic management practices were followed. Grain yield and market price of both *kharif* and *rabi* crops were combined, then added *kharif* crop yield to compute system productivity. Soybean-based system economics (net returns and B: C ratio) were computed based on the prevailing market price of inputs and minimum support price for outputs.

Benefits of PBBF technology under soybean-based cropping systems

After the completion of the seventh year, the results revealed that direct seeding with a BBF machine helped to improve grain



Effect of cropping systems and crop establishment methods on soil parameters under soybean based cropping systems. PBBF+R: Permanent broad bed furrow with residue retention and CTFP+ WR: Conventional tillage as per farmer's practices without residue retention

yield, system productivity, and farmer's income with enhanced soil health benefits. Further, three crops per year in sequence i.e. Soybean (June) - Potato (October) – late sown wheat (January) at Malwa region was the most profitable cropping system with the highest grain yield, system productivity, system net returns, B: C ratio and available nutrients and soil organic carbon

by decreasing rhizosphere soil pH (Table 1 and 2).

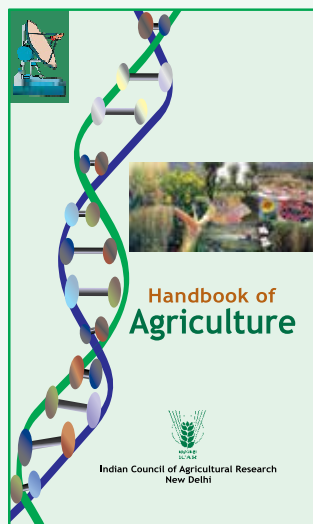
CONCLUSION

The growing of Soybean-Potato-late sown wheat under Permanent Broad Bed Furrow with residue retention (Soybean @ 1.0 t/ha crop residue (CR) to *rabi* crops; Wheat (@ 2.5 t/ha CR) to soybean) improved soil nutrient status, soil

health, crop yield and economics. Therefore, it can be considered a productivity booster, eco-friendly, and remunerative technology for soybean farmers in the Malwa region of central India.

*Corresponding author email: sherawat90rakesh@gmail.com

Handbook of Agriculture



The Handbook of Agriculture is one of the most popular publication of the ICAR with a wider readership. The present edition presents science-led developments in Indian agriculture, the ongoing research efforts at the national level and with some ideas on the shape of future agriculture. While information in some chapters such as Soil and water, Land utilization, field and forage crops has been updated with latest developments, many new topics such as the Environment, agrobiodiversity, Resource conservation technologies, IPM, Pesticides residues, Seed production technologies, Energy in agriculture, informatics, Biotechnology, Intellectual Property Rights, Agricultural marketing and trading and Indigenous Technical Knowledge have been included in the present edition. For those who take intelligent interest in agriculture – and their number is increasing fast – the present edition would serve as a useful book.

TECHNICAL SPECIFICATIONS

Size	: Royal Octavo (16 cm x 24 cm)
No. of pages	: i-xii + 1620
Price	: ₹ 2000
Postage	: ₹ 200
ISBN No.	: 978-81-7164-096-6

For obtaining copies:

Business Manager

Directorate of Knowledge Management in Agriculture
Krishi Anusandhan Bhavan-I, Pusa, New Delhi 110 012
Tel: 011-25843657, Fax: 09-11-25841282; E-mail: bmicar@gmail.com

SCAN QR Code to
Purchase Online

