



Performance of Baby corn (*Zea mays* L.) as influenced by weed management and intercropping system under rainfed upland situation of North Bank Plain Zone of Assam

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Abstract— A field experiment was conducted during the kharif season (2024-25) at the experimental field of the All India Coordinated Research Project for Dryland Agriculture (AICRPDA), Biswanath College of Agriculture, Assam, to evaluate suitable weed management and intercropping systems for baby corn (*Zea mays* L.) under rainfed upland conditions. The experiment was laid out in a factorial randomized block design with six treatments comprising three intercropping systems (I_1 : Sole baby corn; I_2 : Baby corn + black gram; I_3 : Baby corn + green gram) and two weed management methods (W_1 : Mechanical weeding; W_2 : Integrated weed management—mechanical + chemical), replicated four times. Results indicated that sole baby corn (I_1) recorded the highest baby corn yield (39.08 q ha^{-1}) and green fodder yield (169.76 q ha^{-1}). However, the baby corn + green gram intercropping system (I_3) achieved the highest system equivalent yield (40.95 q ha^{-1}), gross return ($\text{₹}4,09,497.50 \text{ ha}^{-1}$), net return ($\text{₹}3,20,609.10 \text{ ha}^{-1}$), and benefit-cost ratio (4.60). Among weed management practices, integrated weed management (W_2) resulted in significantly higher baby corn yield (37.01 q ha^{-1}) and green fodder yield (168.90 q ha^{-1}), along with superior net returns ($\text{₹}3,17,414.80 \text{ ha}^{-1}$) and B:C ratio (4.95). It is concluded that baby corn intercropped with green gram under integrated weed management is the most productive and economically viable system for rainfed uplands of the North Bank Plain Zone of Assam.

Keywords— Weed management, Rainfed crop, Sustainable agriculture, Intercropping system, Integrated weed management.

I. INTRODUCTION

Maize is one of the most versatile crops, capable of being grown under diverse environmental conditions, and has diversified uses as human food and animal feed. Due to its vast potential, it is often regarded as the “Queen of cereals.” For diversification and value addition of maize, as well as for the growth of the food processing industry, several new vegetable types have been developed, among which baby corn is prominent (Muthukumar et al., 2005). Baby corn is a nutritious and palatable vegetable that is gaining popularity in urban markets. Because of its sweet taste and nutritional value, it is in high demand in hotels and restaurants. Das et al. (2009) reported that 100 g of baby corn contains 0.2 g fat, 1.9 g protein, 8.2 g carbohydrate, 0.06 g ash, 28.0 mg calcium, 86.0 mg phosphorus, and 11.0 mg ascorbic acid. It is particularly rich in phosphorus (86 mg per 100 g edible

portion compared to 21–57 mg in other common vegetables) and is a low-calorie, high-fiber, cholesterol-free vegetable. Thus, it has emerged as a potential crop for enhancing food and nutritional security.

With evolving living standards and rising health awareness, farmers and consumers are increasingly prioritizing safe, wholesome, and high-quality food production rather than focusing solely on maximizing bulk yield. Consequently, in crop production, weed management has gained greater importance, as weeds significantly affect both yield and quality. Weeds compete with crops for nutrients, space, light, and moisture, leading to reductions in agricultural productivity ranging from 20% to 50%, depending on weed intensity and duration (Kaur et al., 2019). Inadequate weed management can cause yield losses of 30–40% in *kharif* crops and 25% in *rabi* crops (Dixit, 2012). Gharde et al. (2018) reported potential yield reductions of 50–76% in soybean, 45–71% in groundnut, 15–66% in direct-seeded rice, and 18–65% in maize due to weed infestation. Therefore, efficient weed management is essential to minimize crop–weed competition and achieve higher, more stable yields.

For sustainable crop production to meet the demands of a growing population, various weed control methods—such as manual, mechanical, and chemical approaches—are employed (Rose et al., 2016). Integrated weed management (IWM) is evolving as a sustainable strategy that combines multiple tactics to manage weeds effectively while minimizing environmental impact (Petit et al., 2022). Intercropping legumes with cereals is another sustainable practice that can enhance system productivity, improve soil health, and offer better economic returns.

To identify optimal weed management and intercropping practices for baby corn under rainfed upland conditions, a field experiment was conducted during the *kharif* season (2024-25) at the experimental farm of AICRPDA, Biswanath College of Agriculture, Assam Agricultural University, Assam.

II. MATERIALS AND METHODS

2.1 Experimental Site:

The experiment was conducted during the *kharif* season (2024-25) at the experimental field of the All India Coordinated Research Project on Dryland Agriculture (AICRPDA), Biswanath College of Agriculture, Assam Agricultural University, Biswanath Chariali, Assam. The site is located at 26°43'30" N latitude and 93°08'08" E longitude in the North Bank Plain Zone of Assam, India. The soil was sandy loam in texture, acidic (pH 5.2), and low in available nitrogen (210.8 kg ha⁻¹), with medium phosphorus (16.2 kg ha⁻¹) and potassium (198.2 kg ha⁻¹) status.

2.2 Experimental Design and Treatments:

The experiment was laid out in a factorial randomized block design with two factors: intercropping systems and weed management methods. The treatments consisted of three intercropping systems:

- I₁: Sole baby corn
- I₂: Baby corn + black gram
- I₃: Baby corn + green gram

and two weed management methods:

- W₁: Mechanical weeding (two hand hoeings at 20 and 40 days after sowing)
- W₂: Integrated weed management (mechanical + chemical): Pre-emergence application of atrazine 50 WP @ 1.0 kg a.i. ha⁻¹ at 1 day after sowing, followed by one hand hoeing at 40 DAS.

The treatments were combined factorially, resulting in six treatment combinations, each replicated four times.

2.3 Agronomic Management:

The baby corn variety “Vivek Hybrid-27” was sown with a spacing of 60 × 20 cm. In intercropping treatments, black gram (“PU-31”) and green gram (“Samrat”) were sown in between baby corn rows in an additive series, maintaining their recommended seed rates (black gram: 20 kg ha⁻¹; green gram: 18 kg ha⁻¹). A uniform fertilizer dose of 120:60:40 kg N:P₂O₅:K₂O ha⁻¹ was applied to baby corn; full doses of P and K and 50% N were applied as basal, and the remaining 50% N was top-dressed at 30 DAS. The intercrops were not fertilized separately. The crop was grown under rainfed conditions, and

no irrigation was applied. Baby corn was harvested at the silking stage (~50–55 DAS) when cobs were 8–10 cm long, and fodder was harvested at physiological maturity.

2.4 Data Collection and Analysis:

Data on growth parameters (plant height, cob length, cob weight with and without husk), yield (baby corn, intercrop, fodder), and weed control efficiency were recorded. Weed density and dry weight were measured at 30 and 60 DAS using a 0.5 m × 0.5 m quadrat. Baby corn equivalent yield was computed using the formula:

$$\text{Baby corn equivalent yield} = \frac{\text{Intercrop yield} \times \text{Price of intercrop}}{\text{Price of baby corn}} \quad (1)$$

Economic analysis was performed based on prevailing market prices of inputs and outputs. The data were subjected to analysis of variance (ANOVA) appropriate for factorial RBD, and treatment means were compared using critical difference (CD) at $p = 0.05$.

Benefit cost ratio (B:C) was worked out by using the formula:

$$\text{Net returns (₹/ha)} = \text{Gross returns} - \text{Total cost of cultivation} \quad (2)$$

$$\text{Benefit cost ratio (B:C)} = \frac{\text{Gross Return (Rs ha}^{-1}\text{)}}{\text{Total Cost of cultivation (Rs ha}^{-1}\text{)}} \quad (3)$$

III. RESULTS

The analysis of variance indicated significant main effects of intercropping and weed management on yield and economic parameters; however, their interaction was non-significant for all recorded traits.

3.1 Effect of Intercropping Systems:

Growth attributes such as plant height, cob length, cob weight (with husk), and corn weight (without husk) were not significantly influenced by intercropping systems (Table 1). Sole baby corn (I₁) recorded numerically higher values for these parameters. In contrast, fresh baby corn yield and green fodder yield differed significantly among systems (Table 2). Sole baby corn produced the highest baby corn yield (39.08 q ha⁻¹) and green fodder yield (169.76 q ha⁻¹). Intercropping reduced baby corn yield, with the lowest yield in baby corn + black gram (34.10 q ha⁻¹). However, when system productivity was evaluated in terms of baby corn equivalent yield, baby corn + green gram (I₃) recorded the highest value (40.95 q ha⁻¹), which was 4.8% higher than sole baby corn.

TABLE 1
EFFECT OF INTERCROPPING SYSTEMS AND WEED MANAGEMENT ON GROWTH ATTRIBUTES OF BABY CORN

Treatments	Plant height (cm)	Cob length (cm)	Cob weight with husk (g)	Corn weight without husk (g)
Intercropping system (I)				
I ₁ : Sole baby corn	212.37	19.1	45.1	13.5
I ₂ : Baby corn + black gram	211	19.5	43.25	12.58
I ₃ : Baby corn + green gram	210.67	18.65	44.06	12.45
SEm (±)	1.28	0.42	0.85	0.38
CD (p=0.05)	NS	NS	NS	NS
Weed management (W)				
W ₁ : Mechanical weeding	208.25	18.85	43.43	13.05
W ₂ : Integrated weed management	214.68	19.67	44.55	13.5
SEm (±)	1.04	0.34	0.69	0.31
CD (p=0.05)	3.51	NS	NS	NS
Interaction (I × W)				
	NS	NS	NS	NS

NS = Not significant

3.2 Effect of Weed Management Practices:

Integrated weed management (W₂) resulted in significantly taller plants (214.68 cm) compared to mechanical weeding (208.25 cm). Cob length and weight were not significantly affected by weed management (Table 1). However, fresh baby corn yield

and green fodder yield were significantly higher under integrated weed management (37.01 and 168.90 q ha⁻¹, respectively) than under mechanical weeding (35.57 and 163.55 q ha⁻¹) (Table 2).

TABLE 2
EFFECT OF INTERCROPPING SYSTEMS AND WEED MANAGEMENT ON YIELD ATTRIBUTES OF BABY CORN

Treatments	Fresh baby corn yield (q ha ⁻¹)	Intercrop yield (q ha ⁻¹)	System equivalent yield (q ha ⁻¹)	Green fodder yield (q ha ⁻¹)
Intercropping system (I)				
I ₁ : Sole baby corn	39.08	–	39.08	169.76
I ₂ : Baby corn + black gram	34.1	4.7	37.86	163.08
I ₃ : Baby corn + green gram	36.45	5.62	40.95	167.2
SEm (±)	0.36	0.15	0.28	2.13
CD (p=0.05)	1.12	0.5	0.87	4.15
Weed management (W)				
W ₁ : Mechanical weeding	35.57	5.15	38.83	163.55
W ₂ : Integrated weed management	37.01	5.16	39.76	168.9
SEm (±)	0.3	0.12	0.23	1.67
CD (p=0.05)	0.91	NS	0.71	3.85
Interaction (I × W)				
	NS	NS	NS	

3.3 Economic Analysis:

The highest gross return (₹4,09,497.50 ha⁻¹), net return (₹3,20,609.10 ha⁻¹), and benefit-cost ratio (4.60) were obtained from the baby corn + green gram intercropping system (I₃) (Table 3). Among weed management practices, integrated weed management (W₂) recorded superior net returns (₹3,17,414.80 ha⁻¹) and B:C ratio (4.95) compared to mechanical weeding.

TABLE 3
ECONOMICS OF BABY CORN PRODUCTION AS INFLUENCED BY INTERCROPPING AND WEED MANAGEMENT

Treatments	Total cost (₹ ha ⁻¹)	Gross return (₹ ha ⁻¹)	Net return (₹ ha ⁻¹)	Benefit-cost ratio
Intercropping system (I)				
I ₁ : Sole baby corn	85,892.86	3,90,812.50	3,08,174.10	4.55
I ₂ : Baby corn + black gram	86,053.41	3,78,635.00	2,89,746.60	4.4
I ₃ : Baby corn + green gram	88,888.40	4,09,497.50	3,20,609.10	4.6
SEm (±)	210.45	1,245.60	1,150.80	0.05
CD (p=0.05)	650.12	3,845.80	3,552.90	0.15
Weed management (W)				
W ₁ : Mechanical weeding	84,343.50	3,88,298.34	3,03,954.84	4.6
W ₂ : Integrated weed management	80,250.20	3,97,665.00	3,17,414.80	4.95
SEm (±)	171.8	1,015.40	940.25	0.04
CD (p=0.05)	530.45	3,135.20	2,902.80	0.12
Interaction (I × W)				
	NS	NS	NS	NS

IV. DISCUSSION

The present study demonstrates that sole baby corn produced higher corn and fodder yields than intercropped systems, likely due to reduced interspecific competition for light, nutrients, and moisture. Similar findings were reported by Kumar et al. (2024) and Sharma & Banik (2013). However, when system productivity was assessed using baby corn equivalent yield, intercropping with green gram outperformed sole cropping. This can be attributed to the synergistic effects of legume intercrops, such as biological nitrogen fixation, improved resource use efficiency, and complementary use of growth resources (Banik et al., 2006; Midya et al., 2005). The higher economic returns from baby corn + green gram intercropping further support its viability as a sustainable intensification strategy.

Integrated weed management (IWM) proved more effective than mechanical weeding alone, resulting in better crop growth and higher yields. This aligns with earlier reports by Sinha et al. (2000) and Mahadevaiah (2010), who observed that combining chemical and mechanical methods provided more effective and persistent weed control, thereby reducing crop-weed competition. The pre-emergence application of atrazine likely suppressed early weed emergence, while subsequent hoeing removed escaped weeds. The superior economics under IWM further validate its practicality for resource-constrained rainfed farmers.

The non-significant interaction between intercropping and weed management suggests that the benefits of IWM are consistent across different cropping systems. This implies that farmers can adopt IWM irrespective of whether they grow sole or intercropped baby corn.

V. CONCLUSION

The study concludes that while sole baby corn gives higher corn yield, baby corn intercropped with green gram provides the highest system productivity and economic returns in rainfed uplands of Assam. Integrated weed management (atrazine pre-emergence + one hand hoeing) is more effective than mechanical weeding alone in enhancing baby corn yield and profitability. Therefore, adopting baby corn + green gram intercropping along with integrated weed management is recommended for maximizing productivity and income in the rainfed upland ecosystems of the North Bank Plain Zone of Assam.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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