B. N. SEAL JOURNAL OF SCIENCE
ISSN: 0975-5624
PEER-REVIEWED JOURNAL
https://bnsealjournal.ac.in/

RESEARCH ARTICLE

Received: 26-03-2025
Accepted: 03-06-2025
Published: 30-06-2025

Citation: Alluraiah M, Sarkar MS, Rahim A, Hath TK, Jana JC. Effect of intercropping on chilli (*Capsicum annuum* L.) with marigold (*Tagetes erecta* L.) for insect-pest incidence and profit maximization. B. N. Seal Journal of Science 2025, 13:23-28. https://doi.org/10.5281/zenodo.17553700

DOI: 10.5281/zenodo.17553700

***Corresponding Author:**
Email: janabrinjal@gmail.com

Funding: None

Conflict of Interests: None

Published by:
Office of the Principal,
Acharya Brojendra Nath Seal College, Cooch Behar, West Bengal, India-736101

Effect of Intercropping on Chilli (*Capsicum annuum* L.) with Marigold (*Tagetes erecta* L.) for Insect-pest Incidence and Profit Maximization

Mannem Alluraiah[1], Meghasraya Singha Sarkar[1], Abdur Rahim[1], T. K. Hath[2], J. C. Jana[1*]

[1]Department of Vegetable and Spice Crops, Faculty of Horticulture
Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal, India-736165
[2]Department of Agricultural Entomology, Faculty of Agriculture
Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal, India-736165

Abstract: The experiment was conducted during the rabi season of 2023-24 under terai agro-climatic region of West Bengal in randomized block design (RBD) consisting of seven treatments in three replications with different row ratio of chilli F1 Hybrid Eagle and marigold variety Tall Yellow. Maximum plant height (87.81 cm), plant spread (60.57 cm), fruit yield per plant (360.58 g) of chilli were observed in chilli and marigold row ratio of 2:1 (T_2), while maximum number of primary branches (6.73), individual green fruit weight (3.41 g) in chilli were observed when the row ratio was 3:1 (T_3). The highest green chilli yield of 10.02 t $ha^{-1}$and chilli equivalent yield of 14.51 t ha^{-1} were recorded from sole chilli (T_6) and sole marigold (T_7), respectively. In case of marigold, maximum plant height (55.58 cm), number of flowers per plant (38.07), flower yield (373.42 g $plant^{-1}$ and 12.7 t ha^{-1}) and benefit cost ratio (3.04) were recorded in sole marigold treatment (T_7). Among the different treatments, chilli intercropped with marigold at row ratio of 1:1 (T_1) recorded lowest number of aphids per leaf (0.47 and 0.60 at 70 and 100 DAT, respectively), thrips per leaf (0.53 and 0.58 at 70 and 100 DAT, respectively) and fruit borer larvae per plant (0.33 and 0.47 at 70 and 100 DAT, respectively) that gave least fruit damage of 4.15%.

Keywords: B:C ratio, Chilli, Insect pests, Intercropping, Marigold

Introduction

Chilli (*Capsicum annuum* L.), a significant vegetable crop within the Solanaceae family is widely cultivated and valued for its vitamins, minerals, and medicinal properties. Capsaicin, present in the placenta and pericarp, contributes to its pungency and offers antimicrobial and medicinal benefits [1]. It is an essential ingredient in Indian cuisine. In curries, chilli is used as a paste, powder, broken split or whole form. In Indian pickles, chilli powder is added for thickening and for bright colour. Capsanthin is a natural pigment with no harmful effects on human health it is used in jams, jellies and squashes [2]. At present, India is the largest producer of chillies in the world and in India, Andhra Pradesh is the leading state followed by Karnataka, West Bengal and Odisha. Chilli cultivation faces various biotic and abiotic stresses, including temperature fluctuations, nutrient deficiencies, and pest infestations. Over 20 insect species in chillies are observed in India of which thrips (*Scirtothrips dorsalis*), aphids (*Aphis gosypii* and *A. craccivora*) and mites (*Polyphagotarsonemus latus*) are among the most damaging pests, Intercropping is a sustainable strategy to enhance productivity and resilience.

The practice of growing multiple crops on the same land optimizes resource utilization, improves soil fertility, and enhances natural pest control. Marigold (*Tagetes erecta* L.), belonging to the Asteraceae family has shown promise as an intercrop with chilli due to its pest-repellent properties [3]. It secretes compounds that repel nematodes and insect pests while attracting beneficial predators like coccinellids and chrysopids. Additionally, marigold improves soil aeration and moisture retention and offers economic benefits through flower sales. Intercropping with marigold can reduce insect pest incidence and minimize reliance on chemical pesticides which possess environmental and health risks. The present study aims to evaluate different row ratios of chilli and marigold intercropping to assess their impact on growth, yield and pest incidence, thereby developing a sustainable and profitable production system.

Materials and Methods

The experiment was conducted at Horticulture Instructional Farm, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal. The soil at the experimental location was classified as coarse sandy loam with limited water retention capacity and a low soil pH of 5.7. The experiment was carried out in randomized block design consisting of three replications and seven treatments of chilli intercropped with marigold at 1:1 row ratio (T_1), 2:1 row ratio (T_2), 3:1 row ratio (T_3), 4:1 row ratio (T_4), 5:1 row ratio (T_5), T_6 - sole chilli and T_7 - sole marigold. Good agricultural practices were followed during cultivation. Fertilizers were applied according to the suggested dosages of N: P_2O_5: K_2O at the rate of 100:70:60 kg/ha for both chilli and marigold [4]. The chilli fruits were harvested when they reached their full size with a glossy green appearance and for marigold at complete opening of florets. Observations were recorded on plant height (cm), plant spread (cm) and number of primary branches per plant of both chilli and marigold; number of green fruits per plant, individual green fruit weight (g) , green fruit yield per plant (g), green fruit yield per hectare (t/ha), chilli equivalent yield (t/ha) for chilli and number of flowers per plant, individual fresh flower weight (g), fresh flower yield per plant (g) and fresh flower yield per hectare (t/ha) for marigold. The benefit-cost (B: C) ratio was determined using local input prices, market price of the produces and other relevant factors.

Results and Discussion

Effect on chilli

Plant height, plant spread, number of primary branches, number of green chilli fruits per plant, green chilli yield were significantly influenced by chilli marigold intercropping row ratios (Table 1). Maximum plant height of 87.81 cm, plant spread of 60.57 cm, number of primary branches per plant of 6.73 and green chilli yield per plant of 360.58 g were observed in chilli marigold intercropping system at 2:1 row ratio (T_2) that was statistically at par with treatment of 1:1 row ratio (T_1) and also with the treatment of 3:1 (T_3). This might be due to the effective use of all the available nutrients in the soil and the intercrop marigold, which partially shaded the chilli plants served to conserve soil moisture was responsible for the rise in chilli plant height. The results are in aligning with the findings of Vani *et al*. (2023) [5]. The highest number of 111.27 green chilli fruits per plant was observed in 1:1 row ratio of chilli marigold intercropping system (T_1) that was statistically at par with 2:1 row ratio (T_2). Intercropping chilli with marigold improves soil health through increased organic matter, efficient use of space, water, and nutrients, and enhanced pollinator attraction leading to greater chilli fruit yields. These results align with findings by Sarkar *et al*. (2015) [6]. In the intercropping system chilli plants were grown healthy with less incidence of insect pest [7]. Maximum green chilli yield per hectare (10.02 t ha^{-1}) was recorded in sole chilli (T_6) due to higher number of chilli plants present in the sole chilli crop whereas, minimum green chilli yield per hectare (5.48 t ha^{-1}) was recorded in chilli intercropped with marigold at row ratio of 1:1 (T_1). Similar results were observed by Begum *et al*. (2015) [8] and Alom *et al*. (2014) [9].

Table 1. Growth and yield parameters of chilli as affected by intercropping with marigold

Treatments	PHC	PSC	NPB	NCF	IGCW	GCYP	GCYH
T_1- 1:1 C:M	86.63	58.37	6.40	111.27	3.29	356.50	5.48
T_2- 2:1 C:M	87.81	60.57	6.73	109.60	3.34	360.58	7.68
T_3- 3:1 C:M	84.69	57.75	6.47	107.47	3.41	341.17	8.33
T_4- 4:1 C:M	82.73	56.64	6.27	106.20	3.28	333.92	8.57
T_5- 5:1 C:M	80.64	55.75	6.20	104.27	3.25	328.16	8.69
T_6- C	78.90	54.39	6.00	101.06	3.14	317.09	10.02
T_7- M	-	-	-	-	-	-	-
S. Em±	1.34	0.89	0.13	1.01	0.01	6.36	0.24
C.D.(P=0.05)	4.28	2.84	0.43	3.24	NS	20.31	0.77

Note: PH- Plant height of chilli (cm), PS- Plant spread of chilli (cm), NPB- Number of primary branches per plant, NCF- Number of chilli fruits per plant, IGCW- Individual green chilli fruit weight (g), GCYP- Green chilli yield per plant (g) and GCYH- Green chilli yield per hectare (t ha^{-1}), C- Chilli, M- Marigold, NS- Non-significant.

Effect on marigold

Maximum marigold plant height of 55.58 cm and number of marigold flowers of 38.07 per plant were observed in sole marigold (T_7) which was statistically at par with chilli marigold intercropping system of 2:1 row ratio (T_2) as shown in Figure 1. This might be due to no inter-specific competition for resources such as light, nutrients, water and space. Marigold plants, therefore, can efficiently utilize all available resources to support their growth and development. Data presented in Figure 2 indicated that sole marigold (T_7) gave the highest flower yield per plant and per hectare of 373.42 g and 12.70 t, respectively, followed by the chilli-marigold intercropping system at row ratio of 1:1 (T_1). The lowest marigold flower yield of 326.29 g per plant and 1.85 t per hectare in chilli-marigold intercropping system at row ratio of 5:1 (T_5).

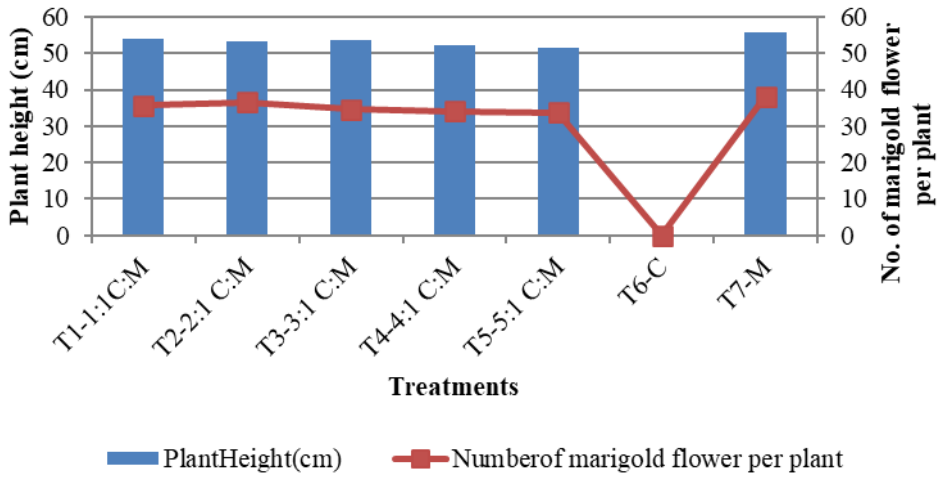

Figure 1. Plant height and number of marigold flower per plant as affected by intercropping with chilli

The substantial increase in yield observed in T_7 compared to T_5 due to greater number of marigold plants accommodated and the efficient utilization of available resources. The absence of competition allow marigold plants to achieve higher biomass accumulation, vigorous growth, and significantly higher flower yield compared to other intercropping systems.

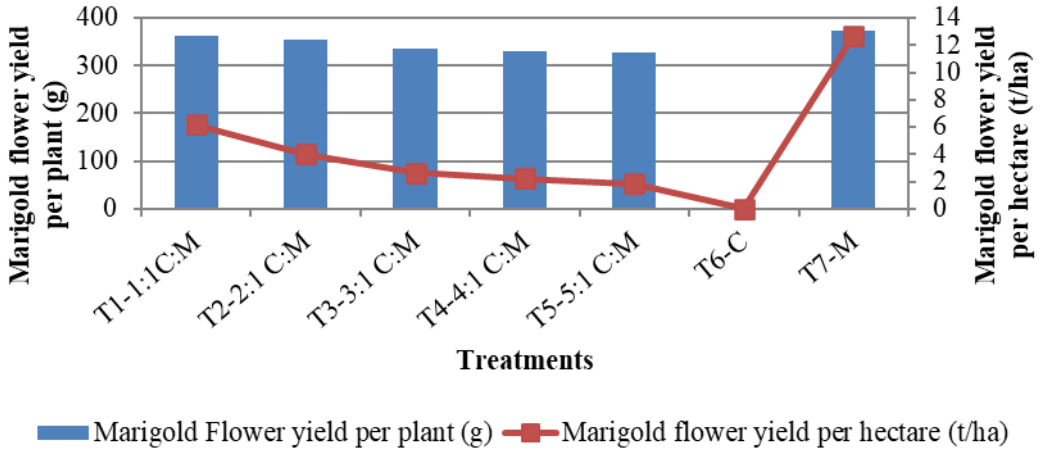

Figure 2. Yield of marigold flower as affected by intercropping with chilli

Insect pest incidence in chilli

The minimum insect pest population (Table 2) of aphid per leaf (0.47 at 70 DAT and 0.60 at 100 DAT), thrips per leaf (0.53 at 70 DAT and 0.58 at 100 DAT), fruit borer larvae per plant (0.33 at 70 DAT and 0.47 at 100 DAT) and fruit damage percentage (4.15 %) were recorded in chilli when intercropped with marigold at 1:1 row ratio (T_1). Whereas, in sole chilli crop with no marigold plant (T6) recorded maximum population of the said insect pests. With the rise up in temperature and fall down in relative humidity at the end of rabi season insect pests population increase in chillies. Marigold plants repel the insect pests and attract natural predators, resulting in a lower pest population in the intercropped system compared to the sole chilli crop. Similar results were observed by Sujay and Giraddi (2016) [10] and Hossain (2021) [7].

Table 2. Population of aphids, thrips, fruit borer and fruit damage of chilli intercropped with marigold

Treatment	Aphids (no./leaf)		Thrips (No./leaf)		Fruit borer larvae /plant		Fruit damage (%) #
	70 DAT*	100 DAT*	70 DAT*	100 DAT*	70 DAT*	100 DAT*	
T1-1:1C:M	0.47 (0.98)	0.60 (1.05)	0.53 (1.02)	0.58 (1.04)	0.33 (0.91)	0.47 (0.98)	4.15 (11.75)
T2-2:1 C:M	0.51 (1.01)	0.62 (1.06)	0.55 (1.03)	0.67 (1.08)	0.40 (0.95)	0.53 (1.02)	4.96 (12.87)
T3-3:1 C:M	0.53 (1.02)	0.64 (1.07)	0.62 (1.06)	0.71 (1.10)	0.53 (1.02)	0.67 (1.08)	5.97 (14.15)
T4-4:1 C:M	0.58 (1.04)	0.69 (1.09)	0.67 (1.08)	0.73 (1.11)	0.60 (1.05)	0.73 (1.11)	7.43 (15.82)
T5-5:1 C:M	0.67 (1.08)	0.73 (1.11)	0.69 (1.09)	0.78 (1.13)	0.67 (1.08)	0.80 (1.14)	8.25 (16.69)
T6-C	0.76 (1.12)	0.82 (1.15)	0.80 (1.14)	0.89 (1.18)	0.87 (1.17)	1.00 (1.22)	9.55 (18.00)
T7-M	-	-	-	-	-	-	-
S.Em(±)	0.02	0.02	0.02	0.03	0.05	0.03	0.23
C.D.(P=0.05)	0.07	0.05	0.08	0.08	0.16	0.10	0.73

*Note: *Figures in parenthesis are $\sqrt{x+0.5}$ transformed values; # Figures in parenthesis are angular transformed values*

Economic analysis

Among the two crops, sole marigold gave high yield of its loose flowers and recorded its high market price compared to chillies under terai agro-climatic region of West Bengal. The maximum chilli equivalent yield of 14.51 t/ha and benefit cost ratio of 3.04 (Figure 3) were recorded in sole marigold crop (T_7) followed by the benefit cost ratio of 2.89 in intercropping system of chilli and marigold in the ratio of 2:1 (T_2) that reduced insect pest incidence in chilli and reduced cost of cultivation for less plant protection measures. Whereas, minimum chilli equivalent yield of 10.02 t/ha and benefit cost ratio of 2.34 in sole chilli crop (T_6). Similar findings were recorded by Khatun *et al.* (2020) [11].

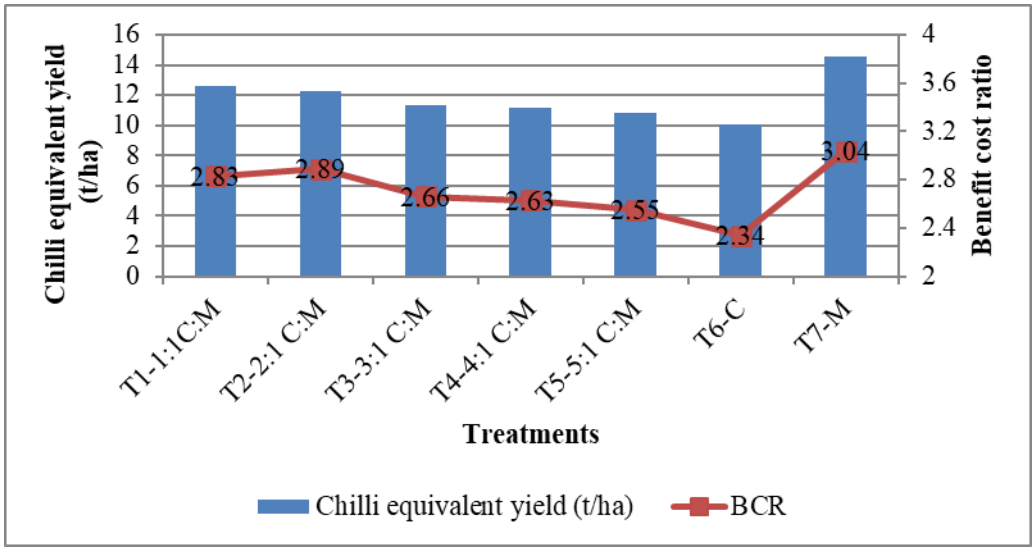

Figure 3. Cost economics of chilli intercropped with marigold

Note: Average market price of chilli and marigold are ₹ 35,000 and ₹ 40,000 per tonne, respectively

Conclusion

Therefore, intercropping of chilli and marigold in the row ratio of 2:1 may be recommended considering high benefit cost ratio, profit maximization among different row ratios and its protection through crop diversification and also reduced insect pest incidence in chilli intercropped with marigold.

References

1. Maharjan A, Vasamsetti B, Park JH. A Comprehensive review of Capsaicin: Biosynthesis, Industrial productions, Processing to Applications, and Clinical uses. Heliyon 2024. https://doi.org/10.1016/j.heliyon.2024.e39721

2. Kumari KU, Jyothi KU, Reddy RVSK, Sujatha RV, Rajendra K, Prasad CP, Sekhar V. Optimization of yield, quality and nutrient uptake of Chilli (Capsicum annuum L) through intercropping and integrated nutrient management practices. Journal of Pharma Innovation 2020, 9(9): 260-263.

3. Sharma G, Rajhansa KC, Sharma P, Singh A, Sharma A, Sahu MK, Pandey AK. Marigold (*Tagetes* spp.): A Diverse Crop with Multipurpose Value for Health and Environment: A Review. Agricultural Reviews 2022. *DOI*, 10.18805/ag.R-2475.

4. Upadhya AK, Singh R, Singh PK, Sengar RK, Kumar M, Singh NV. Effect of integrated nutrient management on plant growth, flower yield of African marigold (*Tagetes erecta* L.). The Pharma Innovation Journal 2022, 11(5): 2064-2069.

5. Vani VM, Revathi K, Srilatha P. Impact of on farm trial on integrated pest management practices in chilli (*Capsicum annuum L.*) in Krishna district of Andhra Pradesh. The Pharma Innovation Journal 2023, 12(5):3190-3192.

6. Sarkar PK, Timsina GP, Rai P, Chakrabarti S. IPM modules of chilli (*Capsicum annuum* L.) in Gangetic alluvial plains of West Bengal. Journal of Crop and Weed 2015, 1(1):167-170.

7. Hossain MM, Singha A, Haque MS, Mondal MTR, Jiku MAS, Alam MA. Management of chilli insect pests by using trap crops. Thailand Journal of Agricultural Science 2021, 54(3):212-221.

8. Begum SA, Zaman MS, Khan ASMR. Intercropping of root crops with chilli in charlands of Mymensingh. Progressive Agriculture 2015, 26(2):109-114.

9. Alom MS, Islam MN, Biswas M, Talukdar AR, Masud MAT. Intercropping chilli with sweet gourd at varying plant population. Bangladesh Journal of Agricultural Research 2014, 39(4): 579-589.

10. Sujay YH, Giraddi RS. Role of trap crops for the management of chilli pests. Journal of Farm Sciences 2016, 29(2):216-220.

11. Khatun MF, Islam MS, Ali MA, Ali MO, Ahmed QM. Intercropping Garlic (*Allium Sativum*) with Chilli (*Capsicum annuum L*) in the Haor Area of Kishoreganj. Bangladesh Agronomy Journal 2020, 23(1):75-81.