



International Journal of Research in Agronomy

E-ISSN: 2618-0618
P-ISSN: 2618-060X
© Agronomy
NAAS Rating (2026): 5.20
www.agronomyjournals.com
2026; SP-9(5): 100-104
Received: 02-02-2026
Accepted: 09-03-2026

Dr. Monika Vijay Kamble
Assistant Professor of Agronomy,
Yashwantrao Chavan, Government
College of Agriculture, Karad,
Satara, Maharashtra, India

Influence of nutrient inputs on growth and yield of zero-tillage cowpea in coastal Konkan conditions

Monika Vijay Kamble

DOI: <https://www.doi.org/10.33545/2618060X.2026.v9.i5Sb.5496>

Abstract

A field experiment was conducted during the rabi season of 2016–17 at the Agronomy Farm, College of Agriculture, Dapoli, to evaluate the effect of integrated crop management practices on growth and yield of cowpea (var. Konkan Sadabahar) under zero-tillage conditions. The experiment was laid out in a randomized block design with eight treatments and three replications. The treatments included a sequential addition of agronomic inputs such as weed control, recommended dose of fertilizers (RDF), biofertilizers (Rhizobium and PSB), multinutrient solution, plant protection measures, paclobutrazol (50 ppm) and one irrigation at pod filling stage. The results revealed that growth parameters including plant height, number of functional leaves and number of branches per plant increased significantly with the intensification of treatments. The highest values for these parameters were recorded under T₈, which comprised all inputs. Similarly, yield attributes such as number of pods per plant showed a significant improvement, indicating enhanced reproductive efficiency. Grain yield and stover yield were also significantly influenced by the treatments. The maximum grain yield (11.16 q ha⁻¹) and stover yield (22.24 q ha⁻¹) were recorded in T₈, which was significantly superior to all other treatments. Treatments T₆ and T₇ also performed well but were inferior to T₈. The lowest yields were observed in the control treatment. The study concludes that integration of nutrient management, biofertilizers, micronutrients, plant protection, growth regulator and irrigation under zero-tillage conditions significantly enhances cowpea productivity. This integrated approach not only improves growth and yield but also contributes to sustainable and resource-efficient farming systems.

Keywords: Cowpea (*Vigna unguiculata*), Integrated nutrient management, Zero tillage, Biofertilizers, Grain yield

Introduction

A unique gem of Indian crop husbandry, pulses. Farmers have farmed pulses for millennia, supplying India's people with nutritious sustenance. Pulses are a valuable gift from nature to humanity. They feed, increase soil health and boost crop yield. Pulses are an essential part of cropping systems nationwide because to their nitrogen fixation capabilities, deep root system, low water need and drought resistance. Pulses help save soil, water and nutrients. Pulses need less water than grains. Cereals use 60% of global water, whereas pulses consume 4%. Pulses utilize water more effectively than other crops owing to their morphology and physiology. Pulses boost crop nutrient efficiency and nitrogen utilization efficiency (Sharma, 2013) ^[19].

Cowpea is a widely adapted and variable crop grown worldwide as a pulse, vegetable, cover crop and fodder. It is also known as crowder pea, black eyepea, kaffirpea, chinapea, sourthen pea, lubia, niebe and coupe. Cowpea (Lobia) is a pulse, fodder and green manure crop. Cowpea, *Vigna unguiculata* L., is a Leguminosae plant with chromosome 2n = 22. It is called vegetarian meat since it is high in proteins and other nutrients. Cowpea grains include 23.4% proteins, 1.8% lipids, 60.3% carbs, 3.4% fiber, 3.3% ash and 9-11% moisture by dry weight. For human consumption and concentrated animal feed (Singh, 2007) ^[21].

Most wild cowpeas originate from Central Africa. Many nations currently have it. The most pulses are grown in Maharashtra, followed by Madhya Pradesh, Uttar Pradesh, Rajasthan and Andhra Pradesh. Pulses yield, area and output were low and constant. Very few districts harvested more than 0.8 or 1 t/ha of kharif pulses (Anonymous, 2013) ^[1]. The mid-1960s New Agriculture Technology (NAT) raised pulse output from 50.82 million tonnes in 1950-51 to

Corresponding Author:
Dr. Monika Vijay Kamble
Assistant Professor of Agronomy,
Yashwantrao Chavan, Government
College of Agriculture, Karad,
Satara, Maharashtra, India

265.64 million tonnes in 2013-14 on 97.32 million hectares to 125 million hectares. India contributed 17.16 million tons of pulses in 2014-15. Maharashtra produced 13.92 million tons of pulses on 11.62 million hectares (Anonymous 2014) [12]. Tillage is mechanically loosening the soil to promote seed germination, seedling planting and crop development. Tillage is the physical conditions created by tillage. Recently, research has shifted the perception of tillage from a "art" to a "science". Zero tillage involves planting seeds directly into untilled soil that retains crop leftovers. Also called no-till. Zero-tillage agriculture practices save water, protect soil fertility, improve output and enhance farmer profitability by lowering production costs. Zero-tillage involves planting crops into untilled soil by opening a thin hole or trench only wide enough to cover the seeds. Other soil tillage is avoided. Zero-tillage cuts expenditures by 15–16%. Positive environmental consequences of zero tillage in Indo-Gangatic plains. It conserves fossil fuels, greenhouse gases and water (Onuh, 2009) [13].

Weed management has traditionally been a resource-intensive crop production process. Weeds deprive agricultural plants of nutrients and water, host insects and pests and complicate harvesting and processing. Good weed control frequently combines available technology with traditional and cultural traditions. Today's intense agriculture causes micronutrient deficiencies. Therefore, micronutrient status and pulse response must be studied. Micronutrients' extensive influence on nodulation and physiological activities has drawn attention to their active function (Pramanik *et al.* 2008) [15]. A micronutrient is a small-quantity element needed for plant development. Micronutrients, like all important nutrients, have specialized functions in plants and must be present in soil above threshold levels in accessible form for the plant to complete its lifespan. These critical nutrients cannot be replaced by other nutrients. The micronutrients (B, Zn, Cu, Mo) are crucial for plant enzymatic processes, chlorophyll synthesis, glucose generation and respiration (Rajesh, 2015) [16].

Foliar sprays need fewer nutrients and absorb them quickly. Foliar nutrients enter cells via the leaf cuticle. Foliar feeding is an essential fertilizing strategy in contemporary agriculture. Increasing cowpea yield requires water management. Based on new scientific information, pulse water needs must be determined urgently. Pulses may produce little because to excessive vegetative growth, flower shedding and immature pods (Vikas *et al.*, 2014). Cowpea yields better in optimal conditions, but environmental changes can cause hormonal imbalance and abscission of assimilatory structures. Plant growth regulators regulate excessive vegetative growth and promote source-sink balance, boosting crop yield (Nagaraju, 1996) [12].

Materials and Methods

The Present investigation was carried under Konkan condition at Agronomy farm, College of Agriculture, Dapoli, Dist Ratnagiri (M.S.) during rabi hot weather season of the year 2016-17. The analytical work was done in research laboratory of the Department of Agronomy.

The field experiment was performed at the Agronomy Farm, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) on plot 22 of 'A' block during rabi season 2016. Rabi cowpea was grown soon after kharif rice harvest using zero-tillage techniques. Precipitation in this subtropical region averages 3500 mm per year, falling from June to October in 95 to 100 days. The meteorological observatory at Agronomy farm, College of

Agriculture, Dapoli collected weather data from 46th MW of 2016 to 7th MW of 2017 (the trial phase). In 2016-17, morning and afternoon RH ranged from 88 to 91.3 percent and 38 to 67.9 percent, respectively. The bright sunshine hours in 2016-17 varied from 6.9 (46th MW) to 9.3 (04th MW). The experimental plot has lateritic soil from mixed parent material. These soils include mostly kaolinite and some illite. Flat terrain makes the experimental field excellent for rabi cowpea growing. By screw auger, composite soil samples were obtained from 30 m deep before the experiment to examine physical and chemical parameters. The recovered soil was dried and stored in aluminum bins. Its physico-chemical characteristics were then examined. The experiment was conducted on cowpea (variety Konkan Sadabahar) using a spacing of 30 × 15 cm. A Randomized Block Design was adopted with three replications to ensure accuracy. Each treatment was applied within a gross plot size of 6.0 m × 4.5 m under uniform agronomic conditions.

Table 1: Treatments

T ₁ : Absolute control	—
T ₂ : T ₁ + Weed control	(2 Hand weeding)
T ₃ : T ₂ + RDF	(25:60:40)
T ₄ : T ₃ + Bio-fertilizers	(Rhizobium and PSB)
T ₅ : T ₄ + Multinutrient solution	(content- N, P, K, S, Zn, Cu, B, Mo)
T ₆ : T ₅ + Plant protection	(Cypermethrin, Phosphamidon)
T ₇ : T ₆ + Paclobutrazol	(50 ppm spray)
T ₈ : T ₇ + One Irrigation	(Pod filling stage)

Plant height (cm): Plant height was recorded from randomly selected five plants and then average was worked out. Height of plant was measured in centimeter from the ground level to the tip of joining of the trifoliate on peduncle.

Number of functional leaves per plant: The number of functional leaves per plant was recorded by counting functional leaves of five sample plants from the net plot and then the average was computed.

Number of branches per plant: Number of branches per plant was studied by counting the main and lateral branches collectively of five randomly selected plants from each net plot and the average number of branches per plant was worked out.

Number of pods per plant: The number of green pods per plant were counted from the five sample plants and the average mean was calculated.

Grain yield (q ha⁻¹): The plot wise grain yield data was recorded after proper drying, threshing and cleaning of cowpea grains. The plot wise data was then converted on hectare basis (q ha⁻¹).

Stover yield (q ha⁻¹): The straw obtained from each treatment plot was sundried for about 10 days, weighed and then per plot straw yield data was recorded and converted on hectare basis (q ha⁻¹).

Statistical tool: Analysis of variance was used to analyze experimental data in randomized block design. Panse and Sukhatme (1967) [23] tested the significance of the treatment difference using a variance ratio test (f value), critical difference (C.D.) at 5% probability and treatment means for statistical interpretation.

Results and Discussion

Plant height (cm)

Plant height (Table 2) in cowpea exhibited a consistent and significant increase with the progressive addition of inputs across treatments. The tallest plants were recorded in T₈ (20.15 cm), which was significantly superior to all other treatments and at par with higher input treatments like T₆ and T₇. Treatments T₃ to T₅ also showed marked improvement over T₁ (absolute control) and T₂, indicating the positive influence of RDF, biofertilizers and multinutrient application. The lowest plant height was recorded in T₂ (7.25 cm), even lower than control (13.06 cm), possibly due to initial stress or treatment imbalance. The overall trend clearly indicates that integrated nutrient management, plant protection and irrigation significantly enhanced vegetative growth. Similarly increase in plant height under application of different fertilizers and bio-fertilizers was observed by Swain and Rathore (2006) [22], Meena *et al.* (2006) [10], Mohite *et al.* (2012) [11]. Increased plant height due to fertilizers, micronutrients and plant growth regulators was observed by Marimuthu *et al.* (2015) [8], increased plant height due to irrigation and fertilizer was recorded by Borse *et al.* (2002) [4].

Number of functional leaves per plant

The number of functional leaves per plant (Table 2) increased significantly with the advancement of treatments. T₈ recorded the highest number of leaves (13.05), followed closely by T₇ (12.22) and T₆ (12.19), showing statistical superiority over lower treatments. The treatments involving RDF, biofertilizers and multinutrient sprays (T₃–T₅) also showed improved leaf production compared to control. The lowest number of leaves was observed in T₁ (7.43). This increase in leaf number can be attributed to improved nutrient availability, better physiological activity and enhanced photosynthetic capacity under integrated crop management practices. These results are in agreement with the results reported by Meena *et al.* (2006) [10], Shah *et al.* (2006), Khan *et al.* (2009) [7], Choudhary *et al.* (2012), Marimuthu *et al.* (2015) [8] in case of fertilizer and irrigation application Borse *et al.* (2002) [4].

Number of branches per plant

Branch development followed a similar increasing trend with the addition of inputs. The highest number of branches per plant (Table 2) was recorded in T₈ (8.38), which was significantly higher than all other treatments. T₇ (7.93) and T₆ (7.84) were statistically comparable and also superior to the rest. Lower treatments like T₁ (4.90) and T₂ (6.19) recorded significantly fewer branches. The increase in branching can be linked to improved plant vigor due to balanced nutrition, growth regulation through paclobutrazol and favorable growth conditions created by irrigation and plant protection measures. Similar findings were recorded by Pramanik *et al.* (2014) [15], for

weeding and bio-fertilizers, Mathur (2000) [9], Meena *et al.* (2006) [10], Gami and Thanki (2011) [6].

Number of pods per plant

The number of pods per plant (Table 2) showed a marked and significant improvement with treatment intensification. T₈ recorded the highest pod number (8.19), which was significantly superior to all other treatments. Treatments T₆ (6.23) and T₇ (6.37) also performed well but were inferior to T₈. The lowest number of pods (2.5) was observed in control (T₁). Intermediate treatments (T₃ to T₅) showed gradual improvement, indicating the role of RDF, biofertilizers and micronutrients in enhancing reproductive growth. Increased pod formation is likely due to better flowering, reduced flower drop and improved nutrient translocation. These findings are close conformity with those of, Shinde *et al.* (1991) [20], Balachandran *et al.* (2005) [3], Dhane *et al.* (2010) [5], Gami and Thanki (2011) [6], Mohite *et al.* (2011) [11], Zaghloul *et al.* (2015) [25].

Grain yield (q ha⁻¹)

Grain yield (Table 2) increased significantly with the integration of improved agronomic practices. The highest grain yield was recorded in T₈ (11.16 q ha⁻¹), which was significantly superior to all other treatments. T₇ (8.55 q ha⁻¹) and T₆ (8.40 q ha⁻¹) were next best and statistically comparable. Treatments involving RDF, biofertilizers and multinutrient application (T₃–T₅) showed moderate yields, while the lowest yield was observed in control (1.98 q ha⁻¹). The substantial increase in yield under T₈ can be attributed to combined effects of balanced nutrition, effective plant protection, growth regulation and irrigation, leading to improved source-sink relationship and higher productivity. These results confirm with the findings of Sarkar *et al.* (1998) [17], Sawargonkar *et al.* (2006), Khan *et al.* (2009) [7], Dhane *et al.* (2010) [5], Patil *et al.* (2011) [14], Marimuthu *et al.* (2015) [8].

Stover yield (q ha⁻¹)

Stover yield (Table 2) followed a trend similar to grain yield, showing significant increases with higher treatment levels. The maximum stover yield was recorded in T₈ (22.24 q ha⁻¹), which was significantly higher than all other treatments. T₇ (15.51 q ha⁻¹) and T₆ (15.50 q ha⁻¹) were statistically at par and superior to lower treatments. The control (T₁) recorded the lowest stover yield (3.92 q ha⁻¹). The gradual increase in stover yield from T₃ onwards reflects the positive impact of integrated nutrient management and improved agronomic practices on vegetative biomass production. Enhanced plant growth, better nutrient uptake and improved physiological efficiency contributed to higher biomass accumulation. These results confirm with the findings of Sarkar *et al.* (1998) [17], Sawargonkar *et al.* (2006), Khan *et al.* (2009) [7], Dhane *et al.* (2010) [5], Patil *et al.* (2011) [14], Marimuthu *et al.* (2015) [8].

Table 2: Growth parameters in experiments

Symbol	Treatments	Plant height (cm)	Number of functional leaves per plant	Number of branches per plant	Number of pods per plant	Grain yield (q ha ⁻¹)	Stover yield (q ha ⁻¹)
T ₁	Absolute control	13.06	7.43	4.90	2.50	1.98	3.92
T ₂	T ₁ + Weed control	7.25	11.25	6.19	5.17	3.84	9.57
T ₃	T ₂ + RDF	18.62	11.44	6.48	5.53	5.53	10.51
T ₄	T ₃ + Bio-fertilizers	18.64	11.47	6.68	5.73	6.05	11.45
T ₅	T ₄ + Multinutrient solution	18.65	11.62	6.77	5.83	6.85	13.00
T ₆	T ₅ + Plant protection	19.17	12.19	7.84	6.23	8.40	15.50
T ₇	T ₆ + Paclobutrazol	19.13	12.22	7.93	6.37	8.55	15.51
T ₈	T ₇ + One Irrigation	20.15	13.05	8.38	8.19	11.16	22.24
	Mean	18.09	11.33	6.90	5.69	—	—
	S.E.±	0.18	0.36	0.01	0.12	0.01	0.01
	C.D. at 5%	0.53	1.08	0.03	0.36	0.02	0.04

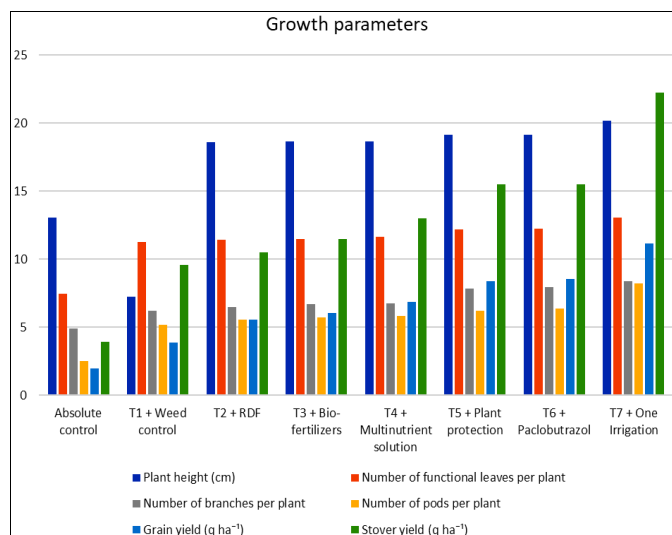


Fig: Growth parameters in cowpea

Conclusion

The present investigation clearly demonstrates that cowpea productivity and growth performance can be substantially enhanced through the adoption of integrated crop management practices under zero-tillage conditions. The study highlights the cumulative and synergistic effects of nutrient management, biofertilizer application, micronutrient supplementation, plant protection measures, growth regulation and irrigation on improving both vegetative and reproductive parameters of cowpea. The progressive increase in plant height, number of functional leaves and number of branches per plant from lower to higher treatment levels reflects the positive influence of balanced and integrated nutrient supply. The combined application of recommended dose of fertilizers (RDF), biofertilizers such as Rhizobium and PSB and multinutrient solutions significantly improved plant vigor by enhancing nutrient availability, uptake efficiency and physiological activities. The addition of paclobutrazol further optimized plant growth by regulating excessive vegetative development and promoting better canopy structure, which ultimately contributed to improved photosynthetic efficiency. The yield attributes, particularly number of pods per plant, showed a marked improvement with the intensification of treatments. This indicates that reproductive efficiency in cowpea is highly responsive to improved agronomic practices. Enhanced flowering, reduced flower drop and efficient translocation of assimilates from source to sink contributed to increased pod formation. Moreover, the study validates the effectiveness of zero-tillage practices in cowpea cultivation under Konkan conditions. Zero tillage not only reduces production costs but also conserves soil moisture, improves soil structure and supports sustainable crop production. When combined with integrated nutrient and crop management practices, it can significantly enhance crop productivity and resource-use efficiency.

References

1. Anonymous. Report of expert group on pulses. New Delhi: Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India; 2013. p. 139.
2. Anonymous. Agricultural statistics at a glance 2011. New Delhi: Department of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India; 2014.

3. Balachandran S, Deotale RD, Hatmode CN, Titare PS, Thorat AW. Effect of biofertilizers (pressmud, Rhizobium and PSB) and nutrients (NPK) on morphophysiological parameters of greengram. Journal of Soils and Crops. 2005;15(2):442-447.
4. Borse PA, Pawar VS, Tumbare AD. Response of greengram (*Phaseolus radiata*) to irrigation schedule and fertilizer level. Indian Journal of Agricultural Sciences. 2002;72(7):418-420.
5. Dhane JB, Shaikh AA. Effect of weed management treatments on yield and quality of soybean. Journal of Maharashtra Agricultural Universities. 2010;35(2):322-325.
6. Gami MR, Thanki JD. Influence of moisture regimes and fertilizer management with and without FYM on summer greengram. Green Farming. 2011;2(3):322-325.
7. Khan S, Rashi A, Khan R. Importance of weed control in chickpea (*Cicer arietinum* L.) under rainfed condition. American-Eurasian Journal of Agricultural and Environmental Sciences. 2009;5(4):456-459.
8. Marimuthu S, Surendran U. Effect of nutrients and plant growth regulators on growth and yield of blackgram. Cogent Food and Agriculture. 2015.
9. Mathur K. Effect of Rhizobium inoculation and various sources of nitrogen on growth and yield of summer greengram [*Vigna radiata* (L.) Wilczek] [thesis]. Hisar: CCS Haryana Agricultural University; 2000.
10. Meena KR, Dahama AK, Reager ML. Effect of phosphorus and zinc fertilization on growth and quality of cluster bean (*Cyamopsis tetragonoloba* L.). Annals of Agricultural Research. 2006;27(3):224-226.
11. Mohite NC, Patil SA, Gosavi SP, Parab PG. Effect of Rhizobium inoculation, liquid fertilizers, micronutrients and growth stimulant on growth and yield of cowpea. Journal of Soils and Crops. 2011;21(2):203-208.
12. Nagaraju AP, Yadahalli YH. Response of cowpea [*Vigna unguiculata* (L.) Walp.] to sources and levels of phosphorus and zinc. Indian Journal of Agronomy. 1996;41(1):88-90.
13. Onuh MO, Donald KM. Effects of water stress on the rooting, nodulation potentials and growth of cowpea. Science World Journal. 2009;4(3):31-34.
14. Patil SD, Dabke DJ, Nigade PM. Effect of different levels of N and K with and without bio-fertilizer on yield, nutrient uptake by cowpea and their correlation in lateritic soils of Konkan. Green Farming. 2011;2(3):316-319.
15. Pramanik SC, Singh K, Singh NB. Irrigation scheduling in chickpea under raised bed planting system. Journal of Food Legumes. 2008;21(1):67-68.
16. Rajesh N, Paul Pandi VK, Durai Singh R. Enhancing the growth and yield of pigeon pea through growth promoters and organic mulching. African Journal of Agricultural Research. 2015;10(12):1359-1366.
17. Sarkar RK, Bhattacharya B, Chakraborty A, Bala B. Growth and productivity of greengram (*Phaseolus radiata*) in relation to micronutrients application on rice fallow land. Indian Journal of Agronomy. 1998;43(3):555-559.
18. Sawargaonkar GL, Sawargaonkar SL, Bhamare VK, Shinde SA, Borgaonkar SB. Optimization of nitrogen and phosphate fertilization for French bean during winter in Marathwada region. Crop Protection and Production. 2006;2(2):56-58.
19. Sharma P, Sardana V, Singh KS. Dry matter partitioning and source-sink relationship as influenced by foliar sprays in groundnut. The Bioscan. 2013;8:1171-1176.
20. Shinde AK, Jamadagni BM, Birari SP. Effect of foliar spray

- of growth regulators and KNO₃ on growth and yield of cowpea (*Vigna unguiculata* L. Walp) variety VCM-8. Indian Journal of Plant Physiology. 1991;34:392-395.
21. Singh YP, Mann JS. Interaction effect of sulphur and zinc in groundnut (*Arachis hypogaea* L.) and their availability in Tonk district of Rajasthan. Indian Journal of Agronomy. 2007;52(1):70-73.
 22. Swain SC, Rathore S. Effect of different fertilizer levels and plant spacings on vegetative growth, yield and quality of yam bean (*Pachyrrhizus erosus* L.) under rainfed condition. Orissa Journal of Horticulture. 2006;34(2):116-118.
 23. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. 2nd ed. New Delhi: Indian Council of Agricultural Research; 1967.
 24. Gupta V, Singh M, Kumar A, Sharma BC, Kher D. Effect of different weed management practices in urdbean (*Vigna mungo*) under sub-tropical rainfed conditions of Jammu, India. Legume Research. 2014;37(4):424-429.
 25. Zaghloul RA, Abou Aly HE, Rasha M. Improvement of growth and yield of pea plants using integrated fertilization management. Universal Journal of Agricultural Research. 2015;3(4):135-143.