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# Impact of conservation agricultural management practices on yield, nutrient content and nutrient uptake under Soybean + pigeon pea – Chickpea cropping system in swell shrink soils

**Chetna S Kumbhar, VK Kharche, SD Jadhao, NM Konde and SM Bhoyar**

## Abstract
A field experiment was conducted during *kharif* and *rabi* seasons of 2018-19 and 2019-20 to evaluate the impact of conservation agricultural management practices on yield, nutrient content and uptake by soybean and chickpea in different villages of Barshi Takali tahsil, Akola District in Maharashtra. Among the ten selected farmers each farmer treated as one treatment. Each sample was treated as one replication and three samples were taken from each site. Thus 10 treatments with 3 replications were studied using RBD design. The results inferred that significantly higher soybean grain yield (24.00, 23.67 q $ha^{-1}$) was recorded during 2018-19 and 2019-20 respectively under conventional tillage. However, higher chickpea grain yield (21.31, 20.83 q $ha^{-1}$) was recorded under ($T_4$) where conventional tillage practices done each year during 2018-19 and 2019-20 respectively. The yield of soybean was comparatively more under conventional agricultural practices, but it was very close to yields obtained in conservation agriculture. Similarly, significant highest nitrogen, phosphorus and potassium content and uptake were registered where the conservation tillage was followed for 15 years along with management of residue.

**Keywords:** Tillage, conservation agriculture, yield, uptake, vertisols

## Introduction
Soybean (*Glycine max*. L.) is one of the important oilseed as well as leguminous crop. Soybean as a miracle "Golden Bean" of the 21$^{st}$ century mainly due to its high protein (40%) and oil (20%) content. In India it is mainly grown as 'oilseed crop'. Soybean (*Glycine max*. L.) is known as sojabean, soybean, Chinese pea and Manchurian bean which belongs to family Leguminaceae and has Eastern Asian Origin. Soybean cultivation has placed India on the world map in recent past. Soybean has not only gained the vital importance in Indian Agriculture, but plays a decisive role in oil economy of India. Chickpea (Cicer arientinum) popularly known as "Gram" OR "Bengal gram" is most important and premier pulse crop of India. Chickpea is the most important grain legume in the world after dry beans and dry peas. Its cultivation is mainly confined to Asia with 90 per cent of the global area and production. Besides Asia it is also grown in North and Central America, the Mediterranean region, west Asia and North Africa (WANA) region and Eastern Africa. Maharashtra is a second major Chickpea producing state after Madhya Pradesh. Maharashtra contributes 18.36 per cent share in area and 20.03 per cent share in production of chickpea in India.
The concept of conservation agriculture is relatively new in Asia. A large share of the conservation agriculture is confined in India and that is in the Indo-Gangetic plain. CA involves soil management practices that include planting of crops with minimum soil disturbance, maintenance of permanent soil cover and diversified crop rotations that improve soil's bio-physico-chemical behaviour, thereby helped us in arresting the land degradation and water pollutions associated with CT practices (Sharma and Behera, 2009) [15, 16]. Conservation agriculture helps to improving crop input-output relationship with conserving the natural resources throughout lowering soil erosion, arresting water losses through reducing soil evaporation, sequestering atmospheric carbon in soil and reducing energy needs of agri-cultural sector (Jat *et al*., 2005; Yadav *et al*., 2016) [5, 20]. The area under zero tillage in Indo-Gangetic plains of India was estimated to be 1.90 million hectare in 2005, which increased to 2.5 million hectares in 2007.

Farm level studies have shown that about 35 per cent of farmers in India Punjab and Haryana adopted zero tillage in rice-wheat system (Erenstein *et al.*, 2007) [2]. Widespread adoption of conservation agriculture practices at a rapid pace in different countries is a testimony of higher benefits to the farmers in comparison of conventional agriculture with respect to reducing cost, enhancing profits and conserving precious resources. Conservation agriculture plays important role in respect of problem associated with intensive agriculture. Wheat yields with CA practices are either equal or even better than those obtained with conventional practices because of timely planting of wheat, efficient use of fertilizers and weed control. In addition, CA is fuel and energy efficient (Jat *et al*., 2014) [6]. Increases in yield production stability, reduced risks and environmental sustainability can only be achieved through management practices that result in an increased soil quality in combination with improved crop varieties. Conservation agriculture has move toward up as a new paradigm to reach goal of sustained agricultural production. It is a major step toward transition to sustainable agriculture. The main aim of conservation agriculture management practices is reversing the process of degradation inherent to the conventional agricultural practices like intensive cultivation and burning or removal of crop residues.

## Materials and Methods

The experiment was conducted on ten farmer's fields identified from three villages namely Sukali, Alanda and Nimbhara of Barshi Takali tahsil, Akola District, Maharashtra during 2018-19 and 2019-20 under Soybean + pigeon pea – Chickpea cropping system. The soils of experimental site were categorized under Inceptisols and Vertisols. The soils were moderately deep to deep black cracking clay soils. They are calcareous in nature and moderately alkaline in reaction and organic carbon. The fertility status of the soils indicates that the soils were, low in available nitrogen, medium in available phosphorus and very high in available potassium. All the selected farmers have been following same cropping pattern for last ten years. Soybean and pigeon pea intercrop was grown in *kharif* season and chickpea was grown in *rabi* season during both years. Each farmer treated as one treatment. Each sample has been treated as one replication and three samples have been taken from each site. Thus 10 treatments with 3 replications has been studied in RBD design. Yield of soybean and chickpea during 2018-19 and 2019-20 was recorded from net plots in all the replications. The plant samples of soybean and chickpea were collected at the time of harvest and analyzed for various nutrient content and uptake of nutrients.

**Table 1:** Treatment details

| Site No. | Tret. | Management Practices |
|---|---|---|
| Site 1 | $T_1$ | -Conservation tillage for 15 years, No ploughing since 15 years, Harrowing, Crop residues incorporated in soil |
| Site 2 | $T_2$ | -Conservation tillage for 8 years, No ploughing since 8 years, Harrowing, Crop residues incorporated in soil |
| Site 3 | $T_3$ | - Conservation tillage for 4 years, No ploughing since 4 years, Harrowing, Crop residues incorporated in soil |
| Site 4 | $T_4$ | -Conventional tillage each year, Regular ploughing each year, Harrowing |
| Site 5 | $T_5$ | - Conservation tillage for 12 years, No ploughing since 12 years, Harrowing, Crop residues incorporated in soil |
| Site 6 | $T_6$ | - Conservation tillage for 10 years, No ploughing since 10years, Harrowing, Tillage preparation by five tines implements, Crop residues incorporated in soil |
| Site 7 | $T_7$ | - Conservation tillage for 6 years, No ploughing since 6 years, Harrowing, Crop residues incorporated in soil |
| Site 8 | $T_8$ | - Reduced tillage for alternate year gap, Alternate 1 year gap ploughing, Crop residues incorporated in soil |
| Site 9 | $T_9$ | - Reduced tillage once in 4 year, Alternate 4 year gap ploughing, Crop residues incorporated in soil |
| Site 10 | $T_{10}$ | - Reduced tillage once in 2 year, Alternate 2 year gap ploughing, Crop residues incorporated in soil |

## Results and Discussion

### Yield

Effect of conservation agriculture management practices was observed on grain and straw yield of Soybean and Chickpea during 2018-19 and 2019-20 and results are presented in Table 2. The significantly higher (24.00 q ha-$^1$) soybean yield was recorded in the treatment $T_4$ where conventional tillage practices executed each year followed by the treatment $T_{10}$ (23.67q ha$^{-1}$) and $T_9$ (23.37 q ha$^{-1}$), where reduced tillage practices adopted once in 2 and 4 year respectively. This was found on par with treatment $T_7$ (22.80 q ha $^{-1}$), $T_6$ (21.27 q ha$^{-1}$) and $T_1$ (22.10 q ha$^{-1}$) where conservation tillage practices adopted since 6, 10 and 15 years respectively. However, during 2019-20 significantly higher (23.67 q ha$^{-1}$) soybean yield was recorded in the treatment $T_4$ under conventional tillage which was found at par with treatment $T_{10}$ (23.65 q ha $^{-1}$), $T_9$ (23.50 q ha$^{-1}$) where reduced tillage practices adopted once in 2 and 4 year respectively and $T_1$ (23.00 q ha$^{-1}$) conservation tillage practices followed for 15 years respectively. Whereas lower values of grain yield of soybean during both year obtained in treatment $T_2$ (21.15, 19.00 q ha$^{-1}$) where conservation tillage practices was adopted for 8 years.

Similarly highest chickpea grain yield was recorded in treatment $T_4$ (21.31, 20.83 q ha$^{-1}$) respectively under conventional tillage which was found at par with $T_{10}$ (20.89, 20.80 qha$^1$) and $T_9$ (20.75, 20.79 q ha$^{-1}$) where reduced tillage practices adopted once in 2 and 4 year respectively during 2018-19 and 2019-20. Lowest chickpea grain yield was obtained under conservation tillage practices done since 15 years i.e. in treatment $T_1$ (18.70, 19.16 q ha$^{-1}$) during both years.

Generally, increased grain and straw yield to be obtained from conservation agriculture as compare to conventional agriculture as soil fertility achieved through long term conservation agriculture management practices. But the lower trend of crop yield is most, might be due to hardness of black cotton soil, poor hydraulic conductivity and poor soil aeration under conservation agriculture practices. However the yields obtained under conservation tillage practices are very close to yields obtained in conventional agriculture systems. Similar finding were reported by Mohanty and Painuly (2003) [9], Sharma *et al.* (2003) [13] and Gurminder *et al.* (2006) [3]. Highest soybean grain yield of was obtained in zero tillage, followed by conventional tillage and bed planting (Singh *et al.* 2005) [14]. Overall, results showed that no-till reduced yields, though variable but under certain conditions no-till can produce equivalent or greater yields than conventional tillage importantly when no-till was combined with the other two conservation agriculture principles of residue retention and crop rotation; its negative impacts were minimized. Moreover, no-till in combination with the other two principles significantly increased rainfed crop productivity in dry climates, suggesting that it may become an important climate-change adaptation strategy for ever-drier regions of the world. Tomar (2008) [17] reported that after 10 years of no tillage there were small increases in yield compared with CT plots under a rice–wheat system on Vertisols. With the adoption of conservation agriculture, the beneficial effects are likely to increase over time due to improvement in soil quality. Results revealed that yield levels of conservation tillage (i.e., no-tillage and reduced tillage) was on par with conventional tillage. Conventional tillage up to the eighth year of the study maintained 12.8 and 11.2% higher sorghum and mung bean grain yields, respectively, compared to reduced tillage. Sharma *et al.* (2009) [15, 16] reported significant effects (8 years) of tillage as well as conjunctive nutrient–use treatments on sorghum and mung bean grain yields at Hyderabad. Conventional tillage up to the eighth year of the study maintained 12.8 and 11.2% higher sorghum and mung bean grain yields, respectively, compared to reduced tillage. After eight years, reduced tillage tended to be equal or better than conventional tillage in improving crop yields.

**Table 2:** Effect of conservation agriculture management practices on grain and straw yield of Soybean and Chickpea.

| Treatment | | Soybean yield (q ha$^{-1}$) | | | | Chickpea yield (q ha$^{-1}$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 2018-19 | | 2019-2020 | | 2018-19 | | 2019-2020 | |
| | | Grain yield | Straw yield | Grain yield | Straw yield | Grain yield | Straw yield | Grain yield | Straw yield |
| $T_1$ | Conservation tillage for 15 years | 22.10 | 25.37 | 23.00 | 25.39 | 18.70 | 20.20 | 19.16 | 21.12 |
| $T_2$ | Conservation tillage for 8 years | 21.15 | 23.97 | 19.00 | 22.70 | 19.92 | 21.13 | 20.44 | 22.00 |
| $T_3$ | Conservation tillage for 4 years | 23.23 | 26.37 | 22.17 | 25.25 | 20.15 | 22.10 | 20.38 | 22.34 |
| $T_4$ | Conventional tillage each year | 24.00 | 28.20 | 23.67 | 25.77 | 21.31 | 23.84 | 20.83 | 24.35 |
| $T_5$ | Conservation tillage for 12 years | 21.17 | 24.40 | 18.70 | 22.33 | 19.05 | 21.89 | 19.21 | 22.43 |
| $T_6$ | Conservation tillage for 10 years | 21.27 | 24.17 | 20.72 | 25.00 | 18.80 | 21.55 | 18.44 | 21.28 |
| $T_7$ | Conservation tillage for 6 years | 22.80 | 26.10 | 21.67 | 23.00 | 19.62 | 22.56 | 20.21 | 22.43 |
| $T_8$ | Reduced tillage for alternate year | 23.03 | 26.80 | 23.03 | 26.67 | 19.73 | 21.72 | 19.54 | 22.05 |
| $T_9$ | Reduced tillage once in 4 year | 23.37 | 26.27 | 23.50 | 26.67 | 20.75 | 23.42 | 20.79 | 22.61 |
| $T_{10}$ | Reduced tillage once in 2 years | 23.67 | 27.17 | 23.65 | 26.93 | 20.89 | 23.79 | 20.80 | 23.93 |
| SE(m)± | | 0.945 | 1.143 | 1.097 | 1.091 | 0.566 | 0.700 | 0.480 | 0.594 |
| CD at 5% | | 2.809 | 3.398 | 3.259 | 3.243 | 1.683 | 2.079 | 1.426 | 1.764 |

**Nutrient content and uptake in Soybean and Chickpea**

**Nutrient content**

Data on total nitrogen, phosphorous and potassium content in soybean as influenced by different tillage practices are mentioned in Table 3. Result revealed that the nitrogen content in soybean was ranged between 1.03 to 1.17% during the year 2018-19 however; it was ranged between 1.04 to 1.19% during the year 2019-20. The treatment $T_1$ recorded significantly higher nitrogen content (1.17 and 1.19%) which was followed by $T_5$ (1.15 and 1.14%) and $T_6$ (1.13 and 1.15%) during 2018-19 and 2019-20 respectively. Moreover, the lower nitrogen content was observed in treatment $T_4$ (1.05 and 1.04%) under conventional tillage. The increase in N content might be due to enhanced symbiosis fixation of N by different plant parts. The reason for higher nitrogen content might be due to increased activity of nitrate reductase in the synthesis of protein in seeds because it is a primary component of amino acids which are the building blocks of protein molecules by Kumawat *et al.*(2009) [7].

From the data it was evident that the treatment $T_4$ having conventional tillage practice for each year showed reduced phosphorous content (0.18 and 0.19%) during 2018-19 and 2019-20 respectively. In contrast, a noticeable higher phosphorous content was observed in treatment $T_1$ (0.32 and 0.34%) under conservation tillage for 15 years which was followed by treatment $T_5$ (0.30 and 0.32%) during 2018-19 and 2019-20 respectively. This increasing content of phosphorus might be due to improved nutritional environment in the rhizosphere by incorporation of crop residues in the soil as well as its utilization in plant system leading to enhanced translocation to reproductive structures and plant parts. Higher nutrient uptake with organic manure application might be attributed to solubilization of native nutrients, chelation of complex intermediate organic manure molecules produced during decomposition of added organic manures, their mobilization, and accumulation of different nutrients in different plant parts (Yadav *et al*. 2013) [19].

The lower potassium content was noticed in the treatment $T_4$ (0.44% in 2018-19 and 0.47% in 2019-20). The different tillage practices significantly influenced the nitrogen, phosphorous and potassium content in chickpea. The highest total nitrogen, phosphorous and potassium content was recorded with conservation tillage for 15 years along with crop residue addition ($T_1$) which was followed by $T_5$ and $T_6$ where conservation tillage practices done for 12 and 10 years respectively. However the lowest was recorded in treatment $T_4$ where conventional tillage was done for each year.

**Table 3:** Nutrient content in Soybean as influenced by different tillage practices.

| Tret. | Nutrient Content of Soybean (%) | | | | | | Nutrient content of Chickpea (%) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | | P | | K | | N | | P | | K | |
| | 2018-19 | 2019-20 | 2018-19 | 2018-19 | 2019-20 | 2018-19 | 2018-19 | 2019-20 | 2018-19 | 2019-20 | 2018-19 | 2019-20 |
| $T_1$ | 1.17 | 1.19 | 0.32 | 0.34 | 0.56 | 0.66 | 1.15 | 1.17 | 0.28 | 0.31 | 0.89 | 0.91 |
| $T_2$ | 1.10 | 1.09 | 0.28 | 0.29 | 0.54 | 0.57 | 1.04 | 1.12 | 0.24 | 0.26 | 0.76 | 0.79 |
| $T_3$ | 1.06 | 1.08 | 0.24 | 0.23 | 0.53 | 0.56 | 0.98 | 1.10 | 0.22 | 0.28 | 0.56 | 0.55 |
| $T_4$ | 1.05 | 1.04 | 0.18 | 0.19 | 0.44 | 0.47 | 0.88 | 0.94 | 0.22 | 0.24 | 0.41 | 0.43 |
| $T_5$ | 1.15 | 1.14 | 0.30 | 0.32 | 0.52 | 0.62 | 1.10 | 1.15 | 0.28 | 0.30 | 0.85 | 0.88 |
| $T_6$ | 1.13 | 1.15 | 0.29 | 0.30 | 0.53 | 0.61 | 1.07 | 1.06 | 0.24 | 0.26 | 0.80 | 0.82 |
| $T_7$ | 1.08 | 1.10 | 0.25 | 0.26 | 0.53 | 0.55 | 1.00 | 1.09 | 0.23 | 0.27 | 0.65 | 0.68 |
| $T_8$ | 1.06 | 1.05 | 0.19 | 0.25 | 0.47 | 0.48 | 0.85 | 0.96 | 0.21 | 0.29 | 0.45 | 0.48 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $T_9$ | 1.04 | 1.06 | 0.22 | 0.21 | 0.52 | 0.54 | 0.94 | 1.02 | 0.21 | 0.26 | 0.53 | 0.59 |
| $T_{10}$ | 1.03 | 1.05 | 0.21 | 0.20 | 0.50 | 0.53 | 0.90 | 1.04 | 0.20 | 0.25 | 0.49 | 0.51 |
| SE(m)± | 0.031 | 0.052 | 0.012 | 0.012 | 0.028 | 0.032 | 0.052 | 0.048 | 0.012 | 0.014 | 0.035 | 0.033 |
| CD at 5% | 0.091 | 0.154 | 0.038 | 0.038 | 0.085 | 0.094 | 0.155 | 0.143 | 0.037 | 0.042 | 0.105 | 0.100 |

**Nutrient Uptake**

The nutrient uptake by soybean was significantly influenced by different conservation agricultural management practices (Table 4). The maximum N, P and K uptake of soybean was obtained with conservation tillage for 15 years; it was significantly superior to conservation tillage for 12, 10 years which were found at par with each other. The uptake of nitrogen by soybean was recorded maximum (26.68, 30.21 kg ha$^{-1}$) under conservation tillage for 15 years during 2018-19 and 2019-20 respectively. The highest uptake of N in conservation tillage might be due to supply of required higher quantity of nutrients for soybean growth thus it directly influences on uptake of higher nutrients in conservation tillage than conventional tillage. The higher nutrient uptake might be due to solubilization of native nutrients, chelation of complex intermediate organic molecules produced during decomposition of added organic manures, their mobilization and accumulation of different nutrients in different plant parts (Sharma *et al*. 2015) [18].

The total uptake of phosphorus was increased with adoption of conservation tillage. The total uptake of phosphorus by soybean varied from (5.08 to 8.12 kg ha$^{-1}$) during 2018-19 and (4.90 to 8.63 kg ha$^{-1}$) during 2019-20. However, the highest phosphorus uptake (8.12, 8.63 kg ha$^{-1}$) was recorded under conservation tillage for 15 years along with crop residue addition which was followed by treatment $T_5$ (7.32, 7.15 kg ha$^{-1}$) and $T_6$ (7.01, 7.50 kg ha$^{-1}$) where conservation tillage done for 12 and 10 years. Under conservation tillage the available P helped to restore high P in soil which led to enhanced uptake by soybean. Microbial release of nutrients enhanced the nutrient concentration in soil and hence more uptake by plants. The increased P uptake might be due to production of organic acids during decomposition of organic matter, which are capable of releasing the P associated with clay minerals and better availability from different sources (Lakshmi *et al*. 2015) [8]. Similarly, total uptake of potassium was increased (14.21, 16.76 kg ha$^{-1}$) in the conservation tillage over the conventional tillage (12.41, 12.11 kg ha$^{-1}$) during 2018-19 and 2019-20 respectively. The conservation tillage practices along with crop residue management practices enhanced the total nitrogen uptake by (0.23, 11.29%), total P uptake by (37.44, 43.22%) and total K uptake by (12.66, 27.74%) over conventional tillage during 2018-19 and 2019-20 respectively. The maximum availability of nutrients due to improvement in soil physical, chemical and biological properties after decomposition of crop residues resulted in and better nutrient uptake. This increase in uptake of nutrients may be attributed to higher N, P, K content, higher dry-matter production and higher seed yield/ha which was owing to continuous supply of essential plant nutrients to plants throughout crop-growth period at higher fertility levels (Morshed *et al*., 2008) [10]. Similar trend was also noted for uptake of N, P and K by chickpea. These results are in close conformity with the findings of Ronanki *et al*. (2018) [12], Gandura *et al*. (2017) [4] and Age *et al*. (2019). Morya *et al*. (2018) [11] also reported that the higher uptake of N, P and K is attributed to continuous and steady supply of available nutrient throughout crop growth period because application of organic and inorganic inputs.

**Table 4:** Nutrient uptake of Soybean as influenced by different tillage practices

| Tret. | Nutrient uptake of Soybean (Kg ha$^{-1}$) | | | | | | Nutrient uptake of Chickpea (Kg ha$^{-1}$) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | | P | | K | | N | | P | | K | |
| | 2018-19 | 2019-20 | 2018-19 | 2018-19 | 2019-20 | 2018-19 | 2018-19 | 2019-20 | 2018-19 | 2019-20 | 2018-19 | 2019-20 |
| $T_1$ | 29.68 | 30.21 | 8.12 | 8.63 | 14.21 | 16.76 | 23.23 | 24.71 | 5.66 | 6.55 | 17.98 | 19.22 |
| $T_2$ | 26.37 | 24.74 | 6.71 | 6.58 | 12.94 | 12.94 | 21.98 | 24.64 | 5.07 | 5.72 | 16.06 | 17.38 |
| $T_3$ | 27.95 | 27.27 | 6.33 | 5.81 | 13.98 | 14.14 | 21.66 | 24.57 | 4.86 | 6.26 | 12.38 | 12.29 |
| $T_4$ | 29.61 | 26.80 | 5.08 | 4.90 | 12.41 | 12.11 | 20.98 | 22.89 | 5.24 | 5.84 | 9.77 | 10.47 |
| $T_5$ | 28.06 | 25.46 | 7.32 | 7.15 | 12.69 | 13.84 | 24.08 | 25.79 | 6.13 | 6.73 | 18.61 | 19.74 |
| $T_6$ | 27.31 | 28.75 | 7.01 | 7.50 | 12.81 | 15.25 | 23.06 | 22.56 | 5.17 | 5.53 | 17.24 | 17.45 |
| $T_7$ | 28.19 | 25.30 | 6.53 | 5.98 | 13.83 | 12.65 | 22.56 | 24.45 | 5.19 | 6.06 | 14.66 | 15.25 |
| $T_8$ | 28.41 | 28.00 | 5.09 | 6.67 | 12.60 | 12.80 | 18.46 | 21.17 | 4.56 | 6.39 | 9.77 | 10.58 |
| $T_9$ | 27.32 | 28.27 | 5.78 | 5.60 | 13.66 | 14.40 | 22.01 | 23.06 | 4.92 | 5.88 | 12.41 | 13.34 |
| $T_{10}$ | 27.99 | 28.28 | 5.71 | 5.39 | 13.59 | 14.27 | 21.41 | 24.89 | 4.76 | 5.98 | 11.66 | 12.20 |
| SE(m)± | 0.547 | 0.815 | 0.483 | 0.519 | 0.376 | 0.869 | 0.414 | 0.812 | 0.520 | 0.646 | 0.784 | 0.363 |
| CD at 5% | 1.626 | 2.421 | 1.436 | 1.542 | 1.118 | 2.583 | 1.231 | 2.414 | NS | NS | 2.330 | 1.080 |

**Conclusion**

Based on the investigation, it is concluded that the conventional tillage recorded higher productivity of soybean and chickpea. However, the results noted in conservation tillage were close to conventional tillage. Conservation agricultural management practices and application of crop residues enhanced the nutrient content and uptake of nutrients by soybean and chickpea. Hence, consistent and long term adoption of conservation tillage practices along with crop residue management practices is advocated for sustains of productivity of crops.

**References**


1. Age AB, Kadu PR, Gabhane VV, Jadhao SD, Mali DV Zodge SD. Effect of various conservation practices on yield and nutrient uptake by soybean under soybean – cotton rotation in Vertisol. J. of Pharmacognosy and Phytochemistry 2019;8(3): 3272-3277.
2. Erenstein, Olaf and Vijaylaxmi Pandey Impact of Zero-Tillage Technology, CIMMYT, Mexico. Adoption and Impact of Conservation Agriculture-based Resource Conservation Technologies. World Congress on Conservation Agriculture organised by the National Academy of Agricultural Sciences 2007, 439-444.

3. Gurminder Singh, Rakesh Kumar, Satinder Kumar. "Effect of tillage and nitrogen levels on growth and yield of maize (*Zea mays* L.)". Ann. Agric. Res. New Series 2006;27(2):198-199.
4. Gandura OA, Gamal Eld-Deen Mohamed, Nouri Mosa Moumen. Influence of Tillage Practices on Soil Physical Properties and Growth and Yield of Maize. Jabal al Akhdar, Libya Open Journal of Soil Science 2017;7:118-132
5. Jat ML, Srivastva A, Sharma SK, Gupta RK, Zaidi PH, Srinivasan G. Evaluation of maize-wheat cropping system under double-no-till practice in Indo- Gangetic plains of India. In 9th Asian Regional Maize Workshop, Beijing, China 2005.
6. Jat RK, Sapkota TB, Singh RJ, Jat ML, Kumar M, Gupta RK. Seven years of conservation agriculture in a rice-wheat rotation of Eastern Gangetic Plains of South Asia: Yield trends and economic profitability. Field Crop Research, 2014;164:199-210.
7. Kumawat N, Kumar R, Sharma OP. Nutrient uptake and yield of mugbean *Vigna radiata* (L.) *Wilczek* as influenced by organic manures, PSB and phosphorus fertilization. Env. Ecol. 2009;27(48):2002-2005.
8. Lakshmi CS, Rao PC, Sreelatha T, Padmaja G, Madhavi Rao. Effect of integrated nutrient management on soil properties, yield and nutrient uptake in rice- greengram cropping system in an Inceptisol of Andhra Pradesh. J Indian Soc. Soil Sci 2015;63(4):400-405
9. Mohanty M, Painuly DK. Land preparatory tillage effects on soil physical properties and growth and yield of rice in a Vertisol. J. Indian Soc. Soil Sci 2003;51(3):217-222.
10. Morshed RM, Rahman MM, Rahman MA. Effect of Nitrogen on seed yield, protein content and nutrient uptake of soybean (*Glycine max* L.). J. Agricultural and Rural Development 2008;6(1, 2):13-17.
11. Morya J, Tripathi RK, Kumawat N, Singh M, Yadav RK, Tomar IS, Sahu SK. Influence of organic and inorganic fertilizers on growth, yields and nutrient uptake of soybean (*Glyscine max* Merril L) under Jhabua hills. Int. J Curr. Microbiol. App. Sci. 2018;**7**(2):725-730.
12. Ronanki Swarna UK, Behera YS, Shivay RN, Pandey S, Naresh Kumar, Rakesh Pandey. Effect of conservation agricultural practices and nitrogen management on growth, physiological indices, yield and nutrient uptake of soybean (*Glycine max*). Indian J. of Agronomy 2018;63(1):33-37
13. Sharma RA, Chauhan SK, Chauhan SS, Shankar GRM. Low till farming practices for resources conservation and soil quality of vertisols under rainfed agriculture. Indian J. Dryland Agric. Res. and Dev 2003;18(2):201-204.
14. Singh SS, Prasad LK, Upadhyaya A. "Root growth, yield and economics of wheat (*Triticum aestivum*) as affected by irrigation and tillage practices in south Bihar. Indian Journal of Agronomy 2005;51(2):131-134.
15. Sharma KL, Kusuma Grace J, Srinivas K, Venkateswarlu B, Korwar GR, Maruthi Sankar G *et al*. Influence of tillage and nutrient sources on yield sustainability and soil quality under sorghum–mung bean system in rainfed semi-arid tropics. *Commu.* Soil Sci. Pl. Analy. 2009;40:2579-2602.
16. Sharma AR, Behera UK. Recycling of legume residue for nitrogen economy andhigher productivity in maize (*Zea mays*)–wheat (*Triticum aestivum*) croppingsystem. Nut. Cyc. Agroeco. 2009;83:197-210.
17. Tomar SS. Conservation agriculture for rice wheat cropping systems. Journal of the Indian Society of Soil Science 2008;56:358-356.
18. Sharma GD, Thakur R, Chouhan N, Keram. Effect of Integrated nutrient management on yield, nutrient uptake, protein content, soil fertility and economics performance of rice (*Oryza sativa* L.) in a Vertisol. J. Indian Soc. Soil Sci 2015;63(3):320-326
19. Yadav SK, Subhash B, Singh Y, Yadav MK, Yadav GS, Pal S *et al*. Effect of organic nutrient sources on yield, nutrient uptake and soil biological properties of rice (*Oryza sativa*) based cropping sequence. *Indian J. Agron.* 2013;58(3):70-75
20. Yadav MR, Parihar CM, Kumar R, Meena RK, Verma AP, Yadav RK *et al*. Performance of maize under conservation tillage, In. J Agri. Sci 2016;8(39):1802-1805.
21. Yadav MR, Parihar CM, Rakesh Kumar RK, Yadav SL, Jat AK, Singh H *et al*. Conservation Agriculture and Soil Quality– An Overview. Int. J Curr. Microbiol. App. Sci 2017;6(2):707-734.