Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2020; 9(3): 1796-1798
Received: 11-03-2020
Accepted: 15-04-2020

**IP Rabari**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**NH Desai**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**KV Rabari**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**PP Chaudhary**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**MP Chaudhary**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**DG Patel**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

**Corresponding Author:**
**KV Rabari**
Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Banasakantha, Gujarat, India

# Crop residue effect evaluation on soil physical and Chemecal properties after harvest of wheat

**IP Rabari, NH Desai, KV Rabari, PP Chaudhary, MP Chaudhary and DG Patel**

## Abstract
A field experiment was carried out during rabbi season 2018-19 to finnd out the effect of crop residue on physical and chemical properties of soil at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Total eight treatments of different crop residue were tested randomized complet block design. An application of castor shell @ 1.00t/ha + mustard husk @ 1.00t/ha + cumin straw @ 1.00 t/ha improved water holding capacity of soil and reduced bulk density and their by improved soil physical property, where as an application of castor shell @ 2.50 t/ha ($T_2$) registered significantly highest value of organic carbon, N, $P_2O_5$ and $K_2O$.

**Keywords:** Crop residue, soil physical property, soil chemical propery

## Introduction
Wheat (*Triticum aestivum* L.) has been described as "Staff of life or king of cereals" and one of the most important staple food crop. Wheat has its own outstanding importance as a human food; it is rich in carbohydrates and protein. About 35 per cent of the world's population directly or indirectly depends upon wheat for food and providing 20% of humanity's dietary energy supply and serving as the main source of protein in developing nations (Braun et al., 2010) [3]. The farmers are using high analyzed inorganic fertilizers to get higher yield of wheat, but continuous and uncontrolled uses of these chemical fertilizers ultimately deteriorate the soil health or physical, chemical and biological properties. Soils which receive plant nutrients only through chemical fertilizers are showing declining productivity despite being supplied with sufficient nutrients. The physical condition of the soil is deteriorated as a result of long-term use of chemical fertilizers, especially the nitrogenous ones. Therefore, integrated nutrient management is highly essential to maintain the soil fertility, productivity and minimize the land degradation and environmental pollution for sustainable agriculture. The incorporation of crop residues can play a vital role in agriculture.

## Materials and Methods
A field experiment was conducted on wheat (*Triticum aestivum* L.) during *rabi* Season 2018-19 with different crop residues on a loamy sand soil at Agronomy Instructional Farm, C. P. College of Agriculture., S.D. Agricultural University, Sardarkrushinagar. The soil of experiment plot was loamy sand in texture having pH 7.8 and EC 0.11 dS/m. Analysis showed that the experimental soil was low in organic carbon (0.17%) and available nitrogen (159 kg/ha) and medium phosphorus (38.9 kg/ha) and pottasium status (270 kg/ha).
Total eight treatments of crop residue like $T_1$: Control, $T_2$: Castor shell @2.50 t/ha,$T_3$: Mustard husk @2.50 t/ha $T_4$: Cumin straw @2.50 t/ha $T_5$: Castor shell @1.25 t/ha + Mustard husk @1.25 t/ha $T_6$: Castor shell @1.25 t/ha + Cumin straw @1.25 t/ha $T_7$: Mustard husk @ 1.25 t/ha + Cumin straw @1.25 t/ha $T_8$: Castor shell @ 1.00 t/ha + Mustard husk @ 1.00 t/ha + Cumin straw @1.00 t/ha were tried with Randomized Complet Block Design (RBD) with three replications. The process of decomposing crop residues was started before 180 days prior to the *rabi* experiment on wheat. The preparation of crop residues *viz.*, each of 300 kg of castor shell, mustard husk and cumin straw were thoroughly filled prior into pre dug pits size of 2.0 × 1.0 × 1.5 $m^3$. The contents were thoroughly mixed overturning it continuously to attain a proper mixer. After mixing crop residues, water was applied periodically at 10 days interval to maintain proper moisture content of 50-60% in the decomposing of crop residues during entire period in pit. The bacterial decomposer consortium was applied @1 lit/tonnes crop residues during preparation of different layers of crop residues in pit. A uniform application of the entire quantity of phosphorus and half dose of N in form of DAP and Urea were manually

applied before sowing of wheat crop in the previously opened furrows as per treatments. After required quantity of crop residues were applied as per the treatment. The remaining half dose of N as per treatments was applied in the form of urea at 21 days after sowing.

Data on soil physical properties i.e bulk density (mg/m$^3$) and soil moisture content (%) at 21 DAS and 65 DAS and soil chemical prperties i.e EC, pH, OC and available N,P and K after harvest of crop were measured.

## Result and Discussion

### Effect of crop residues on soil physical properties

**(A)Soil moisture content (%):** Data on moisture content (%) at 21 DAS and at 65 DAS before irrigation as influenced by different treatments were shown significant result. An application of castor shell @ 1.00t/ha + mustard husk @ 1.00 t/ha + cumin straw @ 1.00 t/ha (T8) registered significantly higher value of moisture content in soil after harvest of wheat. An application of castor shell @ 1.00t/ha + mustard husk @ 1.00 t/ha + cumin straw @ 1.00 t/ha (T8) registered significantly higher value of moisture content (%) at 21 DAS and at 65 DAS before irrigation over the rest of other treatments, but, remained at par with remaining all treatments except treatmentT1(control)at 21 DAS and at 65 DAS. The increase in moisture content might be due to application of crop residues add organic matter improve soil physical properties (Table 1) of soil owing to soil aeration and reduced bulk density of soil which ultimately increase moisture content in soil. The similar results reported by Singh and Kaur (2012) [15], Hari ram *et al*. (2013) [6] and Singh *et al.* (2007) [16].

**Table 1:** Effect of different crop residues on physical and chemecal properties of soil

| Treatment | Soil physical properties | | | Soil Chemical Properties | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Soil moisture content (%) | | Bulk density (mg/m$^3$) | EC (ds/m) | pH | OC (%) | Available nutrient (kg/ha) | | |
| | 21 DAS | 60 DAS | | | | | N | $P_2O_5$ | $K_2O$ |
| $T_1$: Control | 4.50 | 6.71 | 1.47 | 0.173 | 7.69 | 0.26 | 157.2 | 41.33 | 247 |
| $T_2$: Castor shell @ 2.50 t/ha | 5.00 | 8.10 | 1.32 | 0.147 | 7.42 | 0.35 | 189.2 | 48.82 | 300 |
| $T_3$: Mustard husk @ 2.50 t/ha | 5.04 | 8.19 | 1.32 | 0.170 | 7.57 | 0.33 | 175.2 | 46.20 | 297 |
| $T_4$: Cumin straw @ 2.50 t/ha | 5.11 | 8.38 | 1.35 | 0.160 | 7.53 | 0.30 | 167.7 | 44.37 | 277 |
| $T_5$: Castor shell @ 1.25 t/ha +Mustard husk @ 1.25 t/ha | 4.88 | 7.76 | 1.39 | 0.140 | 7.39 | 0.32 | 172.9 | 44.77 | 290 |
| $T_6$: Castor shell @ 1.25 t/ha + Cumin straw @ 1.25 t/ha | 4.94 | 7.90 | 1.34 | 0.137 | 7.36 | 0.27 | 169.8 | 44.72 | 289 |
| $T_7$: Mustard husk @ 1.25 t/ha + Cumin straw @ 1.25 t/ha | 5.00 | 8.07 | 1.40 | 0.147 | 7.54 | 0.32 | 165.6 | 43.72 | 269 |
| $T_8$: Castor shell @ 1.00 t/ha + Mustard husk @ 1.00 t/ha + Cumin straw @ 1.00 t/ha | 5.15 | 8.52 | 1.29 | 0.133 | 7.35 | 0.34 | 172.5 | 46.53 | 295 |
| S.Em± | 0.11 | 0.32 | 0.03 | 0.009 | 0.11 | 0.009 | 5.27 | 1.27 | 10.31 |
| C. D.(P=0.05) | 0.35 | 0.98 | 0.10 | 0.03 | NS | 0.03 | 15.98 | 3.86 | 31.28 |
| C. V. (%) | 3.98 | 7.01 | 4.15 | 9.87 | 2.71 | 5.21 | 5.33 | 4.89 | 6.30 |

**(B)Bulk Density (Mg/m$^3$):** An application of castor shell @ 1.00t/ha + mustard husk @ 1.00t/ha + cumin straw @ 1.00 t/ha (T8)registered significantly lowest value of bulk density in soil after harvest of wheat. but, it was remained at par with remaining all treatments except treatment $T_1$(control) and $T_7$(mustard husk @ 1.25 t/ha + cumin straw @ 1.25 t/ha). The bulk density of soil which is one of the important criteria of physical fertility of soil was affected by addition of organic matter like crop residue. The lowest value (1.29 Mg/m$^3$) under the treatment $T_8$ (castor shell @ 1.00t/ha + mustard husk @ 1.00 t/ha + cumin straw @ 1.00t/ha). This might be due tocrop residue incorporation positively contributed. This was most probably due to complete decomposition and mineralization of added crop residues in soil with 100% RDF nutrients in addition to improvement in soil physical condition by ameliorating toxic effects of soils. Moreover, soil aeration and pore space capacity might have also been improved due to added crop residues that retained comparatively excess moisture and nutrient availability for a longer time. The findings are in agreement with those reported by Sharma *et al.* (2004) [14] and Lal and Mathur (1989) [9].

### Effect of crop residues on soil chemical properties

### (A) Electrical Conductivity

An application of castor shell @ 1.00 t/ha + mustard husk @ 1.00 t/ha + cumin straw @ 1.00 t/ha ($T_8$)registered significantly lowest value of electrical conductivity in soil after harvest of wheat but, remained at par with remaining all treatments except treatment $T_1$(control) and $T_3$(mustard husk @ 2.50 t/ha).This might be due to an application of crop residues in soil application improver soil chemical properties as well as crop residues add organic matter in soil which reduced electrical conductivity of soil. The similar results reported by Beye *et al.* (1978) [2], Yodkeaw and De Datta (1989) and Hope and Burns (1987) [7] in wheat crop.

### (A) Electrical Conductivity

An application of castor shell @ 1.00 t/ha + mustard husk @ 1.00 t/ha + cumin straw @ 1.00 t/ha ($T_8$)registered significantly lowest value of electrical conductivity in soil after harvest of wheat but, remained at par with remaining all treatments except treatment $T_1$(control) and $T_3$(mustard husk @ 2.50 t/ha).This might be due to an application of crop residues in soil application improver soil chemical properties as well as crop residues add organic matter in soil which reduced electrical conductivity of soil. The similar results reported by Beye *et al.* (1978) [2], Yodkeaw and De Datta (1989) and Hope and Burns (1987) [7] in wheat crop.

### (B) Soil reaction (pH)

The data presenting to soil pH as influenced by different treatment was found to be non-significant.

### (C) Organic carbon (%)

An application of castor shell @ 2.50 t/ha ($T_2$) registered significantly highest value of organic carbon content in soil after harvest of wheat.The improvement of organic carbon under this treatment as observed in present study could due to fact that addition of crop residue increase organic matter to the soil which in turn increases organic carbon content in soil. The results are in agreement with those Sainju *et al*. (2000) [12], Dhinan *et al*. (2000), Karanja *et al*. (2006) [8] and Ogbodo (2009) [10] in wheat crop.

**(D) Available N, $P_2O_5$ and $K_2O$ status in soil**

The nitrogen, phosphorus and potash status of soil was significantly influenced due to the effect of various treatments applied in the experiment. The availability of N, $P_2O_5$ and $K_2O$ was considerably increased (189.2, 48.82 and 300 kg/ha) with the application of castor shell @ 2.50 t/ha ($T_2$) over rest of the treatments. But, it remained at par with treatment $T_3$ (mustard husk @ 2.50 t/ha) for nitrogen, treatment $T_3$(mustard husk @ 2.50 t/ha)andT8(castor shell @ 1.00t/ha + mustard husk @ 1.00t/ha + cumin straw @ 1.00t/ha) for phosphorus and treatment $T_3$(mustard husk @ 2.50 t/ha),$T_4$(cumin straw @ 2.50 t/ha), $T_5$(castor shell @ 1.25 t/ha +mustard husk @ 1.25t/ha), $T_6$(castor shell @ 1.25 t/ha + cumin straw @ 1.25 t/ha)and $T_8$(castor shell @ 1.00 t/ha + mustard husk @ 1.00t/ha + cumin straw @ 1.00t/ha), at par with potassium. Significantly the lowestavailable N, $P_2O_5$ and $K_2O$ (157.2, 41.33 and 247kg/ha) was recorded by the treatment $T_1$ (control).

This might be due to integrated application of 100% RDF along with crop residues (castor shell @ 2.50 t/ha) which accumulated in soil resulting in build-up of nutrients in the soil. Increase in available N, $P_2O_5$ and $K_2O$ might be due to the direct addition of nutrients through crop residues and greater multiplication of soil microbes, which could convert organically bound nutrients to inorganic form. These findings are in agreement with those reported by Shafi *et al.* (2007) [13], Ghosh *et al.* (2007) [5], Bahera *et al.* (2007) and Rezig *et al.* (2012) [11] in wheat crop.

## References


1. Behera UK, Sharma AR, Pandy HN. Sustaining productivity of wheat–soybean cropping system through integrated nutrient management practices on the vertisols of central India. Plant and Soil. 2007; 297:185-199.
2. Beye G, Toure M, Arial G. Effect of incorporating straw on the physico-chemical properties of paddy soils of Lower Casamance and on the development of rice. Agronomie Tropicale. 1978; 33:381–389.
3. Braun HJ, Atlin G, Payne T. In: Reynolds, CRP. (ed.). Climate change and crop production, CABI, London, U.K, 2010.
4. Dhiman SD, Nandal DP, Om H. Productivity of rice (*Oryza sativa*) wheat (*Triticum aestivum*) cropping system as affected by its residue management and fertility levels. Indian Journal of Agronomy. 2000; 45:1–5.
5. Ghosh PK, Bandypadhyay KK, Wanjari RH, Manna MC, Mishra AK, Mohanty M. Legume effect for enhancing productivity and nutrient use efficiency in major cropping systems-an Indian perspective: a review. Journal of Sustainable Agriculture. 2007; 30(1):61-86
6. Hari Ram, Dadhwal V, Kumar K, Vashist Kaur H. Grain yield and water use efficiency of wheat (*Triticum aestivum* L.) in relation to irrigation levels and rice straw mulching in North West India. Agricultural Water Management. 2013; 128:92-101.
7. Hope CFA, Burns RG. Activity, origins and location of celluloses in a silt loam soil. Biol. Fert. Soils. 1987; 5(2):164-170.
8. Karanja NK, Ajuke FO, Swift MJ. Organic resources quality and soil fauna: their role on the microbial biomass, decomposition and nutrient release patterns in Kenyan soils. Tropical Subtropical Agroecosyst. 2006; 6:73–86.
9. Lal, Suresh, Mathur BS. Effect of long term fertilization, manuring and liming of an Alfisol on maize, wheat and soil properties. II Soil physical properties. Journal of Indian Society of Soil Science. 1989; 37:815-817.
10. Ogbodo EN. Effect of crop residue on soil chemical properties and rice yields on an ultisol at Abakaliki, Southeastern Nigeria. Am Eurasian Journal Sustainable Agriculture. 2009; 3(3):442–447.
11. Rezig AMR, Elhadi EA, Mubarak AR. Effect of incorporation of some wastes on a wheat–guar rotation system on soil physical and chemical properties. International Journal of Recycling of Organic Waste in Agriculture. 2012; 1:1-15.
12. Sainju UM, Singh BP, Whitehead WF. Cover crops and nitrogen fertilization effects on soil carbon and nitrogen and tomato yield. Canadian Journal of Soil Science. 2000; 80:523-532.
13. Shafi M, Bakht J, Jan MT, Shah Z. Soil C and N dynamics and maize (*Zea mays*) yield as affected by cropping systems and residue management in North Western Pakistan. Soil and Tillage Research. 2007; 94:520–529.
14. Sharma, Peeyush, Tripathi RP Singh, Singh Surendra, Kumar R. Effect of Tillage on Soil Physical properties and Crop Performance under Rice-Wheat System. Journal of the Indian Society of Soil Science. 2004; 52:12-16.
15. Singh A, Kaur J. Impact of conservation tillage soil properties in rice-wheat cropping system. Agricultural Science Research Journal. 2012; 2(1):30-41.
16. Singh G, Jaiota SK, Yadvinder-Singh. Manuring and residue management effects on physical properties of a soil under the rice wheat system in Punjab. India. Soil and Tillage Research. 2007; 94:229-238.