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# The Effect of Potassium Humate, Chicken Feathers and Vermicompost on the Water Retention Curve

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**ABSTRACT**

The present study was carried on sandy-clay loam soil at agricultural research center of Khosroshahr during summer of 2014. The experiment was conducted in factorial total random block form in three repetitions. The first factor was three modifiers (potassium humate, chicken feathers and vermicompost), second factor was the amount of modifiers with 0, 2.5 and 5 levels of weight percentage , and the third factor was application of three moisture levels (0.5, 0.7, 0.9 fc), performed on 27 treatments with three repetitions. Modifiers were incorporated with the soil in plots to the depth of 10 cm. After mixture of modifiers, the wheat was cultivated manually and linear within the plots. Irrigation plan was adjusted according to moisture levels. The applied water was controlled by volumetric flow meters and rubber hoses. Ultimately, undisturbed samples were taken from plots. Results of the study show the saturated moisture of the control group has 5% increase in weight and reached from 0.47% to 0.51% in vermicompost treatment, consequently increasing its pores; while, in chicken feather with 2.5% of weight, saturate moisture has achieved 0.39 that reduced the pores. Applying organic modifiers with 2.5% of weight, the curve slope in vermicompost treatment is more gradual than other treatments, and increased the pores more than potassium humate and chicken feather treatments. However, applying organic materials of 5% weight increased curve slope in vermicompost and potassium humate, which resulted in increase of soil pores.

**KEYWORDS:** Chicken Feather, Potassium Humate, Retention Cure, Vermicompost

## 1. INTRODUCTION

Soil retention curve is one of the main hydraulic features of soil that determines irrigation time, applicable moisture content for the plant, calculates pore size distribution, evaluates soil structure, and determines soil hydraulic conductivity. Direct measurement of soil retention curve is time-consuming and costly, hence, it is tried to use indirect methods for evaluation. Many efforts have been presented in this context and experimental formulas [1]. Maintaining desired level of organic matter is one of the main principals of sustainable agriculture. Application of organic fertilizers in agriculture not only improves soil fertility, but influence physical properties of soil [2]. Many studies have been done to evaluate this feature using easily available parameters such as percentage of clay, silt and soil, soil bulk density, organic matter and grading curve. Various indirect methods has been used to determine retention cure such as pore size distribution model and particle size distribution [3, 4], transition functions [5] and artificial neural networks [6]. This study aims to investigate the effect of three modifiers of soil, including potassium humate, chicken feather, and vermicompost, on soil retention curve under wheat cultivation in different irrigation periods.

## 2. MATERIAL AND METHODS

Agricultural research station of Khosroshahr with 57 hectare area is located in longitude of 37°/56′/58 east and latitude of 46°/2́/24 north with 1300 meter height above the sea level, classified as dry region with hot summers and cold winters. Its annual rainfall is about 320 mm. To do the research, for preparing the samples required for studying the treatments, first the under study farm land was ploughed and then 81 plot with 1*1 m dimensions were generated; to prevent interference of water of plots in each other, about 0.75 m of space was determined between plots using rope and stake. 27 treatments were used in the study including vermicompost in first factor, chicken feather and humate potassium in second factor of modifiers with three levels of 0, 2.5 and 5 weight percentage and third factor with three irrigation level of 0.5, 0.7 and 0.9 fc. After preparation of plots, modifiers were added to the soil with 10 cm depth within the plots and after mixing these modifiers, the wheat was cultivated manually and linear into the plots. Irrigation plan was adjusted according to moisture level and the water amount was measured by volumetric flow meters and rubber hose. The moisture of treatments was daily controlled by sampling of soil up to the desired depth. The amount of applied water was also controlled by volumetric flow meters connected to the hose. The test was carried on pioneer spring wheat. After 5 months, to

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evaluate the effect of each of the treatments on under evaluation features, intact samples were taken from each plot and transferred to the laboratory and measured using pressure containers in 1, 0.1, 0.3 and 0.5 times of suctions. Their retention curve was draw by RETC software.

## 3. RESULTSAND DISCUSSION

Vermicompost increases porosity and water permeability, applicability of nutrients, and functionality [7]. Since the humatic compounds of vermicompost is 40-60% more than compost, the effect of vermicompost on physical features of soil is more than compost [8]. Applying vermicompost on soil, Mirzaei et al. [9] reported this fertilizer leads to porosity of soil texture and increase its pores, ultimately reduces bulk density of soil.

Figure 1 indicates the 2.5 and 5 % level of vermicompost retention curve with control group. Saturation moisture in control group is 0.7; after applying vermicompost modifier the saturation moisture of vermicompost treatments increases to 5% and 2.5 % of weight level measured as 0.51 and 0.48, respectively; that results in increase of pores than control group. Gradual slope curve of vermicompost with 5 and 2.5 percent of weight level specifies the issue.

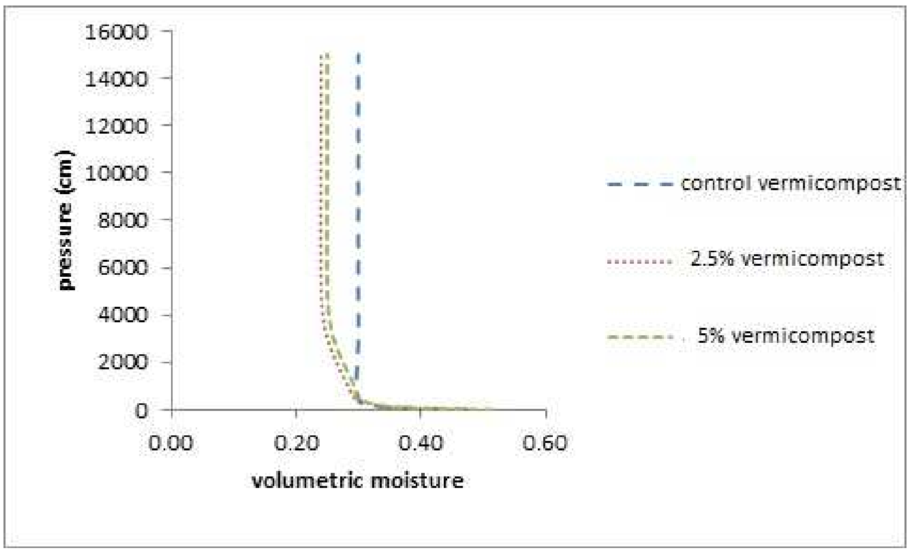


**Figure 1**.comparison of control and vermicompost retention curve

Studies show keratin has the potential to be used as an effective management tools for soil stability. Chicken feather includes high amount of keratin. Since the farmers keep the animals such as chicken along with working at farm, and chicken feather is sold at low price, hence, economically it is in accordance with the farmer condition [10].

Figure 2 indicates the 2.5 and 5 % level of chicken feather retention curve with control group. Saturation moisture in control group is 0.47; after applying chicken feather modifier the saturation moisture of chicken feather treatments decreases to 5% and 2.5 % of weight level measured as 0.46 and 0.39, respectively; that results in decrease of pores. Slope curve of control treatment and 2.5 % treatment of chicken feather is more than 5% chicken feather that indicates large pores. It can be concluded that chicken feather treatment with 5% of weight level has significant influence on increase of small pores and water maintenance.

Addition of organic materials as potassium humate has beneficial corrective effect on soil aggregates. Potassium humate is used to improve soil structure stability against adverse effects of seasonal cycles of dry and moist, which reduce soil structure stability and deteriorate soil aggregates. Reduction of aggregate stability of water in clay-loam soil is less than sandy loam soil [11].

Figure 3 indicates the 2.5 and 5 % level of potassium humate retention curve with control group. Saturation moisture in control group is 0.47; after applying potassium humate modifier the saturation moisture of potassium humate treatments decreases to 2.5 % of weight level measured as 0.45 and increases the moisture in potassium humate treatment with 5% of weight level (0.50); that indicates reduction of pores in 2.5% treatment of potassium humate and increase of pores in 5% potassium humate. Slope curve of 5% treatment is gradual and decreasing, which results in increase of small soil pores, while in 2.5% of weight level treatment, the slope of potassium humate has increased compared to control treatment that results in increase of large soil pores.

Figure 4 indicates the 2.5 % level of vermicompost, chicken feather and potassium humate retention curve with control group. Saturation moisture in control group is 0.47; applying vermicompost, chicken feather and potassium humate modifier has changed the saturation moisture to 0.48, 0.45 and 0.39%, respectively. According to the results, compared to control group, vermicompost increase the pores, potassium humate and chicken feather reduce them; however, the maximum small pores was is vermicompost.

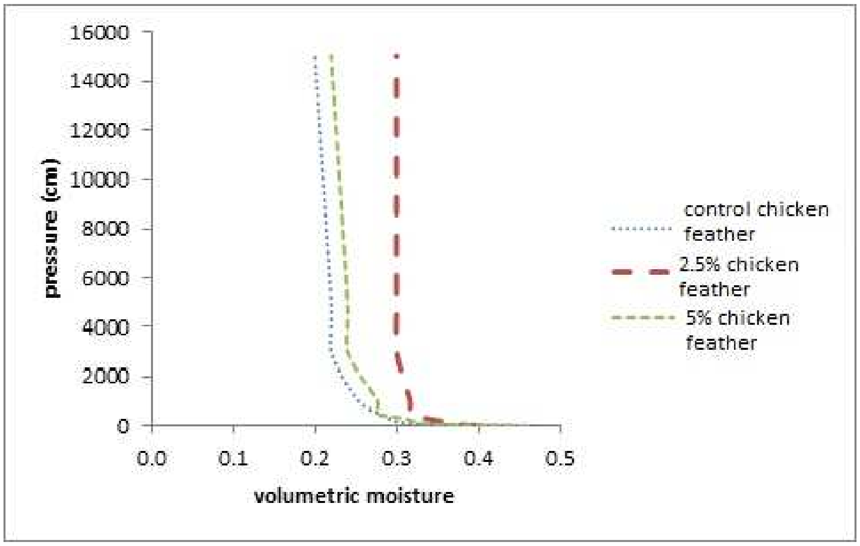


**Figure 2.** Comparison of control and chicken feather retention curve

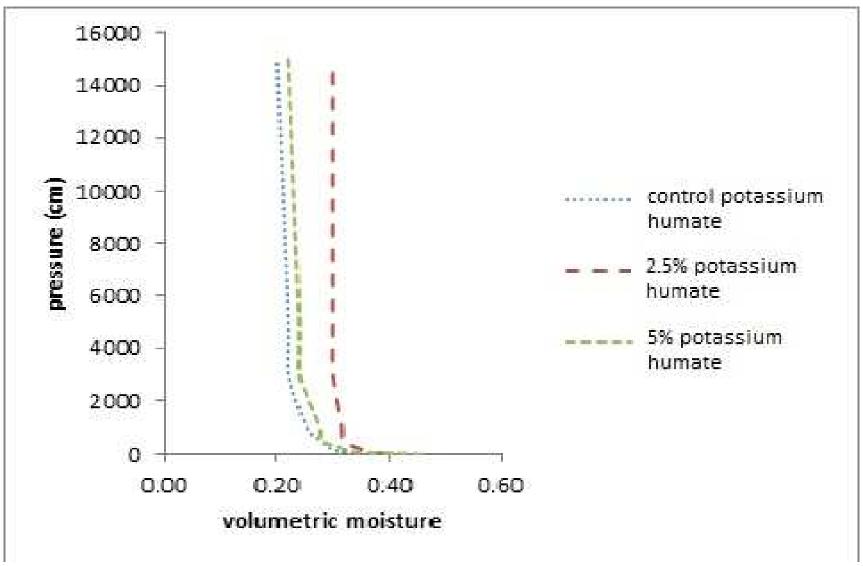


**Figure 3**. Comparison of control and potassium humate retention curve

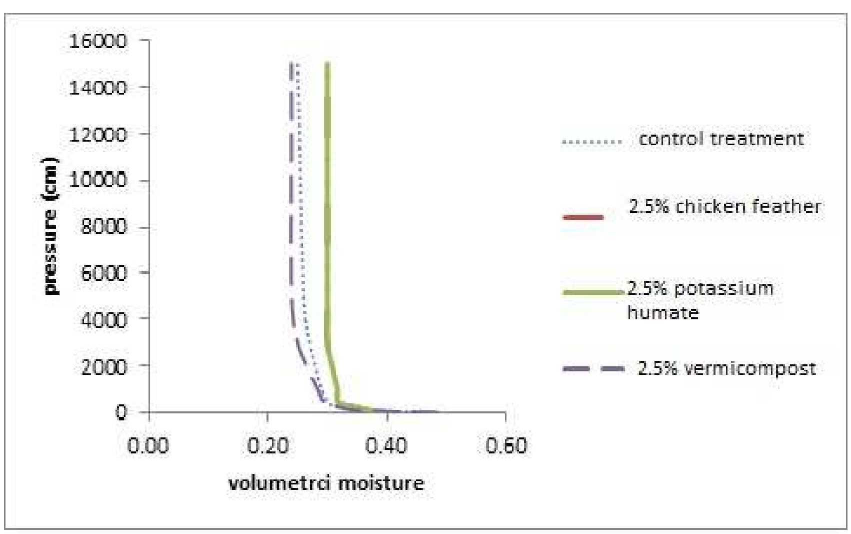


**Figure 4.** Retention curve of 2.5% treatments with control treatment

Figure 5 indicates the 5 % level of vermicompost, chicken feather and potassium humate retention curve with control group. Saturation moisture in control group is 0.47; applying vermicompost, chicken feather and potassium humate 5% organic modifier has changed the saturation moisture to 0.51, 0.50 and 0.46%, respectively. According to the results, it increases the moisture in potassium humate and chicken feather and reduced it vermicompost. The slope of vermicompost treatment is high that results in increase of large pores, while, in potassium humate and chicken feather the slope is gradual and low that increase soil small pores.

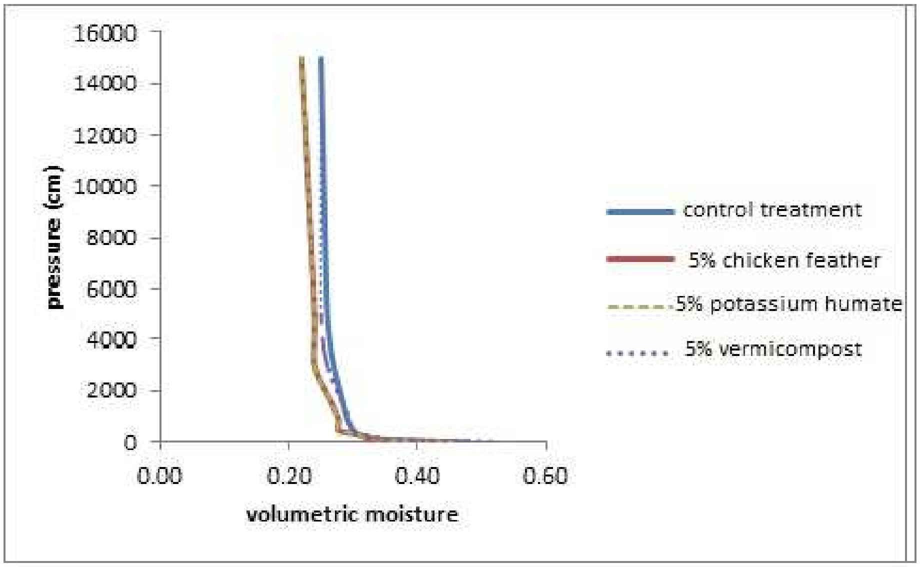


**Figure 5**. Retention curve of 5% treatments with control treatment

## 4. CONCLUSION

Results of the study show treatments have meaningful difference in saturated hydraulic conductivity (p=1%), and the maximum difference is on treatments with 5% weight and moisture of 0.7fc. The results also indicated saturated moisture in control group increased to 0.47%, in vermicompost with 5% of weight to 0.51% and in potassium humate of %5 weight to 0.50% , that lead to the increase of pores, while in chicken weather of 2.5% of weight the control group reached to 0.39% that lead to reduction of pores.

On the study of effect of modifier on physical properties such as the amount of organic material, mean weight diameter (MWD), porosity, pore ventilation, saturated hydraulic conductivity, liquid limit, plastic limit, penetration, drainage rate and maintenance of water in soil in suction rate of 240 cm during two years on silty loam soils, Bryan et al. [12] concluded in first year non of the properties of soil had meaningful changes due to applying treatments. All the other properties, except liquid limit, had meaningful reduction in second year. They believe adverse effect on physical and hydrological properties of soil is because of significant reduction in the size of aggregates and large porosity of soil due to reduction of organic matters during two years of experiments. Reduction of organic matters also attributed to swelling of soil during study period due to intermittent rains

## REFERENCES

1. Alizadeh, A. 2000. Soil, Water and plant Relationships. Astan Quds Razavi press Mashhad, p.170.
2. Zarei, A., Rezaeenejad, Y., Afiuny, M., and Shariatmadari, H. 2005. Residual and accumulation effect on stability, permability and bulk density of soil. Agric. J., 28(1): 108-113. (In Persian)
3. Van Genuchten, M.th. 1980. Aclosed form equation for predicting the hydraulic conductivity of unsaturated soils. Soil Sci. Soc. Am. J., 148(6): 389-403.
4. Arya Land Paris J. 1981. A physic-empirical model to predict soil moisture characteristic From particle-size distribution and bulk density data. Soil Sci Soc Am J, 45:1023-1030.
5. Wosten, j. H.M., and M.Th.van Genuchten. 1988. Using texture and other soil properties to peredict unsaturated soil hydraulic functions. Soil Sci. Am. J., 52: 1762-1770.
6. Minasny, B., Mcbratney A.B. 2007. Estimation the Water retention shape parameter from sand clay content. Soil Sci. Soc. Am, J. 71(4): 1105-1110.
7. Sudhakar, G., Christopher Lourduraj A., Rangasamy, A.Subbian, P.Velayutham, 2002. A Effect of vermicompost application on the soil properties, nutrient availability, uptake and yield of rice, Agric. Rev. 23(2): 127-133.

8. Dominguez, J., C.A.Edwards, and S. Subler. 1997. A comparison of vermicomposting and composting. Biocycle. 38:51-59.
9. MirzaeiTalarPoshti, R., Kambozia, J., Sabahi H., Damghani, A. 2009. The effect of organic fertilizers on physical and chemical characteristics of soil and production of dry tomato, Journal of agricultural studies of Iran, 7 (1): 257-267
10. Imanparast, L. 2011. The effect of potassium humate and keratin on improvement of physical features and structure of soil with presence or absence of microorganisms, M.A. thesis, Soil physique, Islamic Azad University, Tabriz Branch, Iran
11. Balashov, E., Bazzoffi, P. 2003. Aggregate water stability of sandy and clayey loam soils differently compacted with and without wheat plants, Agr. Physics, 17: 151-155.
12. Bryan, C. Fitch, S.K. Chong, J. Arosemena, and G.W. Theseira 1989. Effects of a Conditioner on soil Physical Properties. Soil Sci. Am. J., 53:1536-1539.