TABLE IV: EFFECT OF INDUSTRIAL WASTES ON THE YIELD OF THE SPRING WHEAT, T/HA

Experimental treatments	Effect In 2014	Residual effect in 2015	Average yield	Difference with Control t/ha	%
Control	1,52	1,27	1,40	-	
P_{20}	1,94	1,59	1,77	0,37	26,4
Phosphogypsum 3 t/ha	1,83	1,50	1,67	0,27	19,2
Fly ash 0.4 t/ha	1,74	1,42	1,58	0,19	12,8
Agrobionov 0.4 t/ha	1,85	1,55	1,70	0,31	21,4
Phosphate rock 0.3 t/ha	1,28	1,57	1,43	0,03	2,1

Similar results were obtained in the experiment of Bana et al. (2015), which showed an efficiency of 7.5 % phosphogypsum on wheat that increased its yield up to 6.5 t/ha compared to control of 5.2 t/ha [27].

Residual effect of fly ashes application had a positive effect on yields of spring wheat according to studies of Singh & Singh (1986) [28].

IV. CONCLUSION

To sum up, among all treatments the new fertilizer product "Agrobionov" showed the highest efficiency on the soil microbial activity, nitrogen and phosphorus regime, wheat yield. Moreover, its efficiency rate was almost the same as widely used the superphosphates fertilizers. Furthermore, the application of fly ashes in the rate of 0.4 t/ha and the phosphogypsum in the rate of 3 t/ha allowed considerably increase wheat yield. This is also due to microbial activity that provides favorable conditions for uptake of nitrogen and phosphorous by plants during the vegetation plant growth. On the other hand, the efficiency of treatment with phosphate rock did not differ from control treatment. Therefore, the research results illustrates that an application of alternative types of fertilizers on spring wheat grown on the chernozem soil in the conditions of North Kazakhstan was effective and prospective method.

REFERENCES

[1] A. Yumagulova, *Soil fertility and its control methods;* Almaty: Kainar, 1985, p. 24. (In Russian).

[2] S. B. Kenenbaev, "Conservation of the soil fertility is a major problem in agriculture", *Vestnik selskohozyastvennyx nauk Kazakstana*, vol. 12, pp. 25-26, 2003. (In Russian).

[3] A. K. Kireev, "Increasing a soil fertility and crop yields of wheat by means of biologization of rainfed agriculture", *Vestnik selskohozyastvennyx nauk Kazakstana*, vol. 6, pp. 29-32, 2000. (In Russian).

[4] A. S. Saparov, "Biological productivity of the soil in Kazakhstan in the conditions of anthropogenesis", *Soil Science and Agricultural Chemistry*, vol. 1, 2008. (In Russian).

[5] A. T. Husainov, *Agro-ecological conditions of chernozem soil in the Northern Kazakhstan;* Kokshetau, 2001, p. 7. (In Russian).

[6] N. Beletskaya and I. Fomin, *Guidelines for the application of fertilizers based on local resources;* Petropavlovsk, 2011, p. 5-15. (In Russian).

[7] G. M. Purtov, A.T. Husainov, and R.K. Husainova, "Fodder production on the reclaimed lands of natural Siberia", in the "*Collection of Scientific Studies of the Siberian Research Institute of Fodder Production",* Novosibirsk, 1991, pp. 40-51. (In Russian).

[8] R. D Delaune, J. D. Porthouse and W.H. Patrick, "Effect of phosphogypsum on respiration and methane emissions in sediment", *Environ. Tech.,* vol. 27, pp. 575-584, 2006. http://dx.doi.org/10.1080/09593332808618661

[9] E. Grebenshchikova, "Effect of fly ash on soil properties and content of heavy metals during its application for the soil quality improvement", Candidate dissertation, Dept. Biol. Sc., Vladivostok, 2007. (In Russian).

[10] N. A. Yeledhalli, S.S. Prakash, M.V. Ravi and R. Narayana, "Long-Term Effect of Fly Ash on Crop Yield and Soil Properties", *Karnataka J. Agric. Sci.,* vol. 21(4), pp. 507-512, 2008.

[11] A. A. Sarsenova, K. M. Aitchanova and Y. I. Ermohin, "Application of new product based on the zolyunosa and technical carbon for the reclamation of chernozem soil of forest-steppe zone of Western Siberia," presented at the Scientific Practical Conference devoted to the 125th Anniversary of K. P. Gorshenin and the 100th Anniversary of N. D. Gradoboeva, Omsk, September 24-25, 2013.

[12] V. Redkov, *Soils of Tselinograd Province*; Alma-Ata: Nauka, 1964, pp.325–326, (in Russian).

[13] T. H. Anderson and K. H. Domch, "Ratios of microbial biomass carbon to total organic carbon in arable soils", *Soil Biol. Biochem.,* vol. 21, pp. 471-479, 1989. http://dx.doi.org/10.1016/0038-0717(89)90117-X

[14] G. Machulla, M.A. Bruns and K.M. Scow, "Microbial properties of mine spoil materials in the initial stages of soil development", *Soil Sci. Soc.Am. J.,* vol. 69, pp. 1069-1077, 2005. http://dx.doi.org/10.2136/sssaj2004.0271

[15] Lee Chang Hoon, B.Y. Ha, Y.B. Lee and P.J. Kim, "Effect of alkalized PG on soil chemical and biological properties", *Comm. Soil Sci. Plant Anal.,* vol. 40, pp. 2072-2086, 2009. http://dx.doi.org/10.1080/00103620902960591

[16] S. Mukhina, "Yield formation and grain quality of corn in the conditions of different mineral nutrients on the common chernozem soil in the South-East CCZ," Candidate Dissertation, Dept. Agric. Sc., Kamennaya step, 1999.

[17] S Cerevelli, G. Petruzzelli, A. Perna, R. Menicagli, "Soil nitrogen and flyash utilization: a laboratory investigation," *Agrochemica,* vol. 30, pp. 27-30, 1986.

[18] M.H. Wong, J. W. Wong, "Effects of fly ash on soil microbial activity", *Environ Pollut Ser A,* vol. 40, pp. 127-44, 1986. http://dx.doi.org/10.1016/0143-1471(86)90080-2

[19] J.R. Pitchel, "Microbial respiration in flyash/sewage sludge amended soils", *Environ Pollut,* vol. 63, pp. 225-37,1990. http://dx.doi.org/10.1016/0269-7491(90)90156-7

[20] M. Saxena, P. Asokan. and S. Murali, "Pilot scale demonstration study on impact of fly ash on soil fertility and crop yield" presented at the International Conference on Energy Environment and Disasters-INCEED2005, Charlotte, NC, U.S.A, July 24-30, 2005.

[21] P. K. Sarangi, D. Mahakur and P.C. Mishra, "Soil biochemical activity and growth response of rice Oryza sativa in fly ash amended soil", *Bioresour. Technol.,* vol. 76, pp. 199-205, 2001. http://dx.doi.org/10.1016/S0960-8524(00)00127-9

[22] O. V. Dubrovina, "Effect of fertilizers and phosphogypsum on grain yield, and grain quality, as well as soil fertility in the conditions of the South-East CCZ", Candidate dissertation, Dept. Agric. Sc., Kamennaya steppe, 2004.

[23] R. N. Garg, H. Pathak, and D. K. Das, "Use of flyash and biogas slurry for improving wheat yield and physical properties of soil", *Environ Monit Assess,* vol. 107, pp. 1-9, 2005. http://dx.doi.org/10.1007/s10661-005-2021-x

[24] K. S. Grewal, P. S. Yadav, and S. C. Mehta, "Direct and residual effect of flyash application to soil on crop yield and soil properties", *Crop Res,* vol. 21, pp. 60-5, 2001.

[25] E. K. Melnikova, "Optimization of mineral nutrients of spring wheat crop on common chernozem soil of South-East CCZ", Thesis dissertation, Dept. Agric. Sc., Kamennaya steppe, 2000.

[26] L. N. Nikolchenko, "The content of environmentally hazardous elements in the soil and agricultural crops during the application of industrial wastes", in L. N. Nekolchenko, S.G. Gorohova, N. B. Krivosheev, Collection of Integrated Crop Protection and Phytosanitary Monitoring of Contemporary Agriculture, Stavropol, pp. 194-199, 2004.

[27] R. S. Bana, Y. S. Shivay and V. K. Tyagi. "Effect of Summer forage crops and phosphogypsum-enriched urea on soil quality, nitrogen-use efficiency and quality of Basmati rice (Oryza sativa) and their residual effect on succeeding wheat (Triticum aestivum)", *Indian Journal of Agricultural Sciences,* vol. 85 (4), pp. 531–8, 2015.

[28] N.B. Singh and Singh M, "Effect of flyash application on saline soil and on yield components, yield and uptake of NPK of rice and wheat at varying fertility levels", *Ann Agric Res,* vol. 7, pp. 245-257, 1986.