

Abstract

Today, in order to have a sustainable agricultural system, it is necessary to use the inputs that improve the ecological aspects of the system and reduce environmental hazards and the replacement of chemical inputs with ecological compatible inputs, considered as a step towards the transition from traditional to sustainable agriculture. In this regards, an experiment was conducted on split split-plot based on a randomized complete block design with three replications, at the Research Station of Bayakola (Mazandaran Agricultural and Natural Resources Research Center), during growing season of 2015-2016 and 2016-2017. Experimental treatments were plant nutrition with NPK, (300, 270 and 125 kg/ha of urea, simple super phosphate and potassium sulphate, respectively), animal manure (30 t/ha), compost (20 t/ha), vermicompost (15 t/ha) and control (no chemical and organic fertilizer) as main plot, biofertilizer (bio-phosphate, nitroxin, nitroxin + bio-phosphate), nano bio-fertilizer (bioumik) and control (no bio and nano bio-fertilizer) as subplot and different nutritional systems (direct, residual, and cumulative) as sub sub-plot. The results indicated that the interaction of organic and inorganic, bio and nano-fertilizer treatments and different fertilization systems (direct, residual and cumulative) were significant ($P \leq 0.01$) for all studied traits except for soil texture determinant characteristics (clay, silt and sand percentage). Minimum soil bulk density, pH and C/N ratio and maximum organic matter, nitrogen and organic carbon percentage, highest plant height, main stem diameter, number of shoots per plant, number of leaf per plant, total leaf area per plant, fresh and dry weight of root, stem and leaf, leaf chlorophyll a, chlorophyll b, total chlorophyll, total carotenoid and total carbohydrate, leaf and grain protein percentage, leaf and grain nitrogen concentration, leaf calcium, zinc, iron, copper and manganese concentrations, minimum leaf sodium concentration, maximum capsule per plant, number of seeds per capsule, thousand seed weight, number of seeds per plant and seed yield, total alkaloids content of root, stem, leaf, flower and seed at vegetative, flowering and fruiting stages, hyoscyamine and scopolamine content were due to the cumulative effect of the vermicompost in combination with nano bioumik fertilizers treatment and there was no significant difference between the three nutritional effects (direct, residual and cumulative). Maximum soil electrical conductivity, soil available phosphorus and potassium, leaf and grain phosphorus and potassium concentrations were happened in the cumulative effect of the combination of animal manure with nano bioumik treatment and the highest magnesium concentration belonged to the cumulative effect of the combination of organic compost with nano bioumik treatment. The highest leaf sodium belonged to the cumulative effect of the combination of organic manure and non-application of bio and nano bio-fertilizer and the maximum soil bulk density was obtained from the cumulative effect of the combination of chemical fertilizer treatment and non-use of bio and nano bio-fertilizer. As the plant age increased, the total alkaloid content of different organs decreased. In all three vegetative, flowering and fruiting stages, the highest total alkaloid content among the plant organs belonged to the leaves. GC/MS identified 39 compounds (tropane alkaloid). The dominant alkaloids in different parts of the plant at different stages of growth were hyoscyamine followed by scopolamine. According to the results, for most of the studied traits in direct, residual and cumulative fertilization systems, the highest values were obtained in the vermicompost in combination with nano bioumik fertilizer treatment and there was no significant difference between the three nutritional effects in this treatment. Therefore, with respect to the production of medicinal plants in the low-input cropping systems and to achieve sustainable agriculture and environmental protection, using a load of combinations of vermicompost and nano bioumik fertilizers for two consecutive years are recommended for improving soil physical and chemical properties and increasing agronomical, physiological, and biochemical attributes of datura.

Keywords: Agronomic traits, Biochemical traits, Nano bioumik, Physiological traits, Soil physicochemical properties, Vermicompost.



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