

Long Term of Cattle Manure Amendments and Its Impact on Triticale (*X. Triticosecale Wittmack*) Production and Soil Quality

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Abstract

Organic amendment is a good alternative to improve soil fertility to maintain or increase crop forage and grain production. After several times of organic applications (crop cycles), it is important to follow soil physical and chemical parameters to avoid soil pollution such as salinity and nitrate. The main objective of this study was to maintain good triticale forage production and soil quality after seven years in plots where two factors were studied: cow manure amendments; 0, 40, 80, 120 and 160 t ha⁻¹ and one chemical level with 150-100-00 kg ha⁻¹ of Nitrogen, Phosphorus and potassium, respectively just to compare manure amendments. After this, to decrease soil salinity and high levels of nitrate, triticale forage was planted in the same plots using two varieties without manure and chemical fertilizer application. Triticale variables measured were green forage and ential (Ph) and Nitrates (NO₃). Results indicated that triticale forage production was high in all plots were cow manure was applied after three years than the control and chemical fertilizer level, also, the chemical soil parameters such as, salinity and nitrate decrease to adequate levels of: 4 mmhos cm⁻¹ in salinity and less than 20 ppm of nitrates. Triticale forage production was better in all plots with cow manure application with more than 25 mg ha⁻¹, that's the triticale average production in this region and more than 100% of the control and chemical fertilizer plots. According to these results, cow manure amendments is a good alternative to get high triticale forage production and maintain a good soil quality.

Ke words: Manure; Soil pollution; Nitrate; Production of the crop and salinity

Introduction

Mexico has a production of 61 million tons of manure considering only the feedlot cattle and partial barn, where the main basin of this important tt49 (oan Ea-Lang (en-US)Mn-US)Mtran cause degradation of

forgetting that the key is to avoid inappropriate use of a resource to protect the quality of soil and water [10,11].

e fodder produced in the spring-summer cycle, is not enough to feed the livestock during the winter season, this caused the producers to look for alternatives to help them supplement the food supply, both in quantity and quality this season [12].

e Comarca Lagunera is the most important dairy region of Mexico and Latin America. A good alternative that has been used to replace alfalfa as a protein source is growing forage triticale [13]. is a winter crop, which has been included in the diets of dairy cattle, since this crop brings a high potential for biomass production (10.59 mg ha⁻¹ of dry matter), with adequate nutritional value (16.76% PC), it is also very tolerant to adverse environmental factors.

Materials and Methods

Geogra hic location

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amount of manure nutrients available in the soil for plants, is perhaps one of the most common questions without exact answer because of the many physical, chemical and biological factors involved in the process of decomposition of organic materials [4]. One of the most precise ways is by evaluating the decomposition of manure in the eld directly [5].

e use of this fertilizer is unquestionably bene cial, but there are di culties to predict its e ect in every situation due to the great variability of the material covered and the di erences created by the previous management [6]. In this case a classi c5 Tm[59M6 (i)-3 (a)-4.9 (l co)16 (v)8 (er)1Cme a (e)-8 (v)-3 (io)11 (u)0ang (en-US)MCID 1

N (denitri cation processes and ammonia volatilization loss as NO₃ leaching [8,9].

Producers who use this fertilizer, use it indiscriminately applying a high dose of 200-250 tons per hectare per year, making it necessary to carry out an analysis of the salt balance and soil quality without

47° 22' west longitude and 24° 22' and parallel 26° 23' North latitude. The average height above sea level is 1,139 m. It consists of a hilly expanse and other at where agricultural and urban areas, comprising an area of 4,788,750 ha are located [11]. According to Koeppen classification modified by Cervantes. The climate is dry desert or warm steppe with summer rains and cool winters. The average annual temperature is 21°C, with an average annual evaporation of about 2,396 mm [15].

The rainfall is 258 mm [15]. In the region the predominant clay soils are heavy duty, medium sandy loam [15]. Soil type that was used is clay type, which interferes with ground mineralization as reported by Vazquez et al. [15]. This research was conducted in the experimental agricultural field of the Faculty of Agriculture and Animal Husbandry-UJED, which is located at km 28 of the Gomez Palacio-Tlahualilo, Durango road, to nearby Venice ejido, municipality of Gomez Palacio, Durango.

Soil characteristics and manure

Three random samples of soil and manure were collected to be analyzed at the laboratory of FAZ-UJED [14], to determine the conditions in which the soil and manure were before the establishment of the experiment.

Establishment of experiment

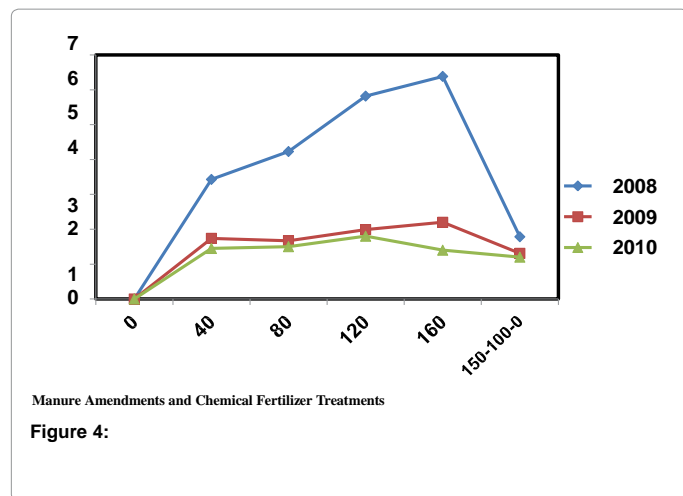
The experiment was conducted in the fall-winter cycle of the years 2008, 2009 and 2010, after planting corn every year since 1978. Initially, since this year the experiment was established with doses of bovine manure of 0, 40, 80, 120 and 160 Mg ha⁻¹ with characteristics shown in Table 1 and further treatment with chemical fertilizer 150-150-0 kg ha⁻¹ of nitrogen, phosphorus and potassium, respectively. These treatments were distributed in field under a randomized block design arrangement in strips, where each group contained three replicates in an experimental unit of eight meters wide by eight meters long with. Statistical analysis was performed with the Statistical Analysis System software package Ver. 9.

After 2004 manure doses were reduced by 50% because it was detected through the soil analysis that the salinity levels increased higher than 4 cm mmhos cm⁻¹ (Table 2). This action was not enough to reduce the salinity to permissible values lower than the 4 mmhos cm⁻¹

of 20 Mg ha⁻¹ of bovine manure. Also, the treatments of 40 and 80 Mg ha⁻¹ of manure applied were statistically equal with 57.86% from the control which showed a lower yield, chemical fertilizer was higher than the control but less than all cattle manure treatments reaching 36.8% more yield forage compared with the control. These results clearly indicated that the manure increased forage yields a few several times that was applied in the soil, for this reason it is a good alternative for farmers to save money in chemical fertilizer and to get good yields in this region, similar results were found by Salazar et al. [17-19].

Soil and manure characteristics

Table 1 shows the soil test before starting the original experiment in 1998. It shows that the ground has normal characteristics of the soils in the region with a low content of organic matter (OM), alkaline pH and low salt Electric Conductivity (EC) less than 4 mmhos cm⁻¹ and very low levels of nitrate (NO₃), ammonium (NH₄), phosphorus (P₂O₅), potassium (K⁺), that had very low fertility to 120 cm depth. Regarding the manure (Table 1 and 2) and after analyzing its features in a pile of accumulation at different depths up to 50 cm, a total range of nitrogen was found from 1.27 to 1.51 with wide variations in other nutrients as; P₂O₅, K⁺, Ca²⁺, Mg²⁺, Na⁺, Mn²⁺, Fe²⁺, Zn²⁺, Cu



Discussion

According to the results found, cow manure amendments are important to improve soil crop forage production. However, special care is necessary to maintain good soil quality with respect to salinity