



P-ISSN: 2349-8528
 E-ISSN: 2321-4902
 IJCS 2018; 6(3): 298-301
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 Received: 25-03-2018
 Accepted: 26-04-2018

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Bio-efficacy of cow urine on crop production: A review

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Abstract

During the last two decades, there has been a significant sensitization of the global community to looking into environmental conservation and safe food. Organic Agriculture (OA) is now becoming the mainstream all over the world. Among different organic sources cow urine is a unique product of dairy which have huge property such as manure, antimicrobial agent, disinfectant. It contains 95% water, 2.5% urea, and remaining 2.5% contains mineral salts, hormones and enzymes. In organic farming, cow urine is used for preparation of number of growth promoter and bio-pesticides, which are effective in improving soil fertility, and management of large number of pests and diseases in varied group. The biochemical contents of the plants increased with cow urine application. Therefore the use of cow urine provides better alternative to synthetic chemicals which are expensive and pose potential danger to the farmers, marketers, consumers, and environment. Application of cow urine has been reported to have a favorable impact, for enhancing productivity of different crops viz., mustard, maize and rice etc. Further research is required to prove its qualities and benefits.

Keywords: Bio-pesticides, Biofertilizer, cow urine, growth, soil fertility

Introduction

The exploitative agriculture for centuries in our country has brought down the fertility status of the soil to a level that even the application of fertilizers at higher rates is unable to sustain the productivity of soil. Intensive use of chemicals gives an immediate effect on crop production for small duration but creates long term ill effects on both ecosystem and soil health leads to environmental problems and increased production costs.

On one hand chemical fertilizers alone do not provide all the nutrients in balanced quantities needed by the plants and on the other hand encourage depletion of soil organic matter content, adversely affect biological and physical properties of soil, also their increasing prices, soil health deterioration, sustainability and pollution consideration in general have led to renewed interest in the use of organic manures. The Use of organic manure not only helps to sustain crop yields but also plays a key role by exhibiting both direct as well as indirect influence on the nutrient availability in soil by improving the physical, chemical and biological properties of soil and also improves the use efficiency of applied fertilizers.

Livestock is the oldest resource for mankind. With small holdings and small scale farming, there is no other better alternative than involving cattle in farming system. The abundant quantity of cattle excreta consisting of dung and urine is available at farm level. Though part of cattle dung is used as manure after decomposition but Cow urine usually drains out as waste material from farmer household. Cattle urine is a good source of nitrogen, phosphate, potassium, calcium, magnesium, chlorite and sulphate. It contains 95% water, 2.5% urea, 2.5% others (mineral salts, hormones and enzymes). This nutrient source is available to farmers free of cost in their own house; being organic in nature it is eco friendly and if used in crops has no adverse effect on ecosystem and human health. Further organic nutrient spray (cow urine) can be sprayed at critical growth stage of crop to overcome the problem of the slow release nutrients of organic sources affecting crop growth.

Application of cow urine besides improving the soil texture and working as a plant hormone also been reported to correct the micronutrient deficiency, being organic in nature it is also likely increase the fertilizer use efficiency.

The uric acid in the urine acts as fertilizer and hormone. Cow urine has antibacterial, antifungal, antiviral properties; hence it is most effective secretion of animal origin with multitudinous therapeutic values it also purifies and enhances soil fertility. However, cattle urine has a good manurial value and can be utilized as a bio fertilizer. (Ledgard *et al.*, 1982) [10]. In organic farming, cow urine is used for preparation of number of bio-enhancers and bio-pesticides, which are effective in improving soil fertility, quick decomposition of organic wastes and management of large number of pests and diseases in varied group. Organic formulations viz cow urine, neem extract, vermiwash, fish wash could be a potent source to move forward soil fertility, crop productivity and quality and additionally control of pest and diseases. This could additionally make a possibility elective to fertigation which is becoming common in most of the crops (Verma *et al.*, 2017) [16, 24].

Effect on plants growth and yield

Cow urine could be a potent source to improve soil fertility, crop productivity and quality. This can also be a potential alternative for fertigation which is becoming common in most of the crops (Pathak and Ram., 2013) [13]. Application of 125 kg N ha⁻¹ through urine significantly increased vegetative characters and application of 100 kg N ha⁻¹ through urine significantly increased yield and quality characters, fifty percent substitution of urea by urine produced better morphological, yield and quality character than other combinations of urine and urea (Khanal *et al.*, 2010) [8]. A study was conducted on effect of two foliar sprays of different concentrations of cow urine (2%, 4%, 6%) at 25 and 40 days after sowing on soybean. Result showed a concentrations of 6% was more effective in enhancing the morpho-physiological, chemical biochemical and yield and yield contributing parameters when compared with control (Deotale *et al.*, 2011). Application of cow urine on chickpea at the rate of 10% at flowering initiation and 15 days after flowering recorded higher plant height (35.78 cm), number of branches (4.82), leaf area index (1.30), number of pod plant⁻¹(60.86), and grain yield (2114 kg ha⁻¹) as compare to control (Patil *et al.*, 2012) [15]. Enhance flower production in bush jasmine, using cow urine in various concentrations at monthly intervals (Sobhana, 2014).The grain and Stover yield of maize varied significantly under different levels of panchagavya spray and cow urine levels. Maximum grain yield of 18.6 q ha⁻¹ and 17.6 q ha⁻¹ were recorded with application of cow urine and panchagavya respectively (Devakumar *et al.*, 2014) [3]. Application of nitrogen @ 90 kg ha⁻¹ with 60 kg ha⁻¹ potassium and phosphorus + cow urine was found to be the best treatment regarding growth, yield and nitrogen content of paddy (Singh *et al.*, 2014) [19]. Different sources of urine applied to the soil as fertilizer improved soil nutrient status and agronomic yield parameters of maize (Nwite, 2015) [11]. Combination of organic materials (feces + urine + paitan + mycorrhiza + azolla 2 kg) and (feces + urine + paitan + mycorrhiza + azolla 3 kg) recorded significantly tallest plant with maximum LAI compared to inorganic fertilizer in paddy crop (Andreeilee *et al.*, 2015) [1]. Application of cow urine on buckwheat recorded higher plant height (116.2 cm), stem girth (0.64 cm), leaves plant⁻¹ (13.5), root length (12.6 cm), seed plant⁻¹ (102), and test weight (22.4) (Singh *et al.*, 2015) [20]. Oliveira *et al.* (2009) in Zimbabwe studied the effect of cow urine at different concentrations (0.00, 0.25, 0.50, 0.75, 1.00 and 1.25%) on the growth and yield of 'Regina 2000' lettuce. The highest yield was obtained with the concentration

of 1.25% applied to leaves and with 1.01%, applied to soil, corresponding, respectively to increases of 28.1% and 47.3%, in comparison to the control. Number of fruit, highest fruit weight, volume, fruit yield kg/plant and yield tons/ha of mango recorded significantly maximum with 55% cattle urine with six sprays over rest of the treatment. (Damodhar *et al.*, 2010) [2].

Effect on nutrient content and uptake

The nutritional effect of cow urine on *Trigonella foenum-graecum* (Methi) and *Abelmoschus esculentus* (Bhindi) plants showed increased chlorophyll and protein content with increased concentration of urine as compared to control (Jandaik *et al.*, 2015) [7]. Urine increased the N concentration of grass and increased the potassium concentration of grass and clover (Ledgard *et al.*, 1982) [10]. The highest value of N, P and K uptake and its content on mustard recorded with combine application of 100% recommended dose of fertilizer with 1200 lha⁻¹ cow urine as basal and foliar Spray of 50% urine. (Pradhan *et al.*, 2017) [16].

Effect on soil physical and chemical properties

Cow urine application has also reported to improve the soil texture and structure. High dose of Liquid Cow Manure application resulted in increased pH and EC values, nutrients and Dissolved Organic Carbon content of amended soils (Aguilera *et al.*, 2010). Application of FYM 12.5 t ha⁻¹+cattle urine at 34300 l ha⁻¹ significantly increase soil organic carbon (0.58%), available nitrogen (272.4 kg ha⁻¹), phosphorus (23.5 kg ha⁻¹) and potassium (199.9 kg ha⁻¹) (Veerasha *et al.*, 2014). Significantly higher total nitrogen, available phosphorus and exchangeable Ca and Mg in soil are recorded with different sources of urine application compared with the Control. Although, there were not significant differences among the treatments in pH, organic carbon, exchangeable K and Na, the values for these parameters are higher than the control ones. (Nwite *et al.*, 2015) [11].

Effect on soil microbial population

Compost tea (cow dung+cow urine+water) contains high amounts of microbes which have complementary effect on the native microbes and also favour decomposition of organic matter at a faster rate which, result in better transformation of nutrients and their availability to crops (Pathak and Ram, 2002) [13]. showed that after regular use of cow urine in the crops farmers of vadodara found that soil microorganism population increased along with the crop yield. They concluded that cow urine worked as growth promoters. there was no occurrence of any insect pest and diseases. Incorporation of increasing dose of LCM (liquid cow manure) resulted in increased respiration activity, C-CO₂ evolution and soil enzymatic activities of amended soils (Aguilera *et al.*, 2010). Significantly higher soil microbial population viz., bacteria (47.0 × 10⁵ cfu/g), fungi (34.6×10⁴ cfu/g) and actinomycetes (40.0×10³ cfu/g) were obtained with the application of FYM 12.5 t ha⁻¹+cattle urine at 34300 l ha⁻¹ as compared to control (Veerasha *et al.*, 2014).

Effect on Insects

In Ethiopia, the pest was controlled with water extract of neem, *Nicotiana tabacum* L., *Capsicum annum* L. or *Allium cepa* L. mixed with fermented cow urine (Tesfaye and Gautam, 2003) [22]. Caterpillars of armyworm, defoliate soybean seedlings and young plants. Older plants though survive but show retarded growth. A mixture of cow urine

and water extract of neem leaves protected soybean crop from the pest (Purwar and Yadav, 2003) [17]. Gupta (2005) [6] reported that cow urine is safer to insect predators (particularly coccinellid beetles). These studies when extended to other natural enemies would reveal whether urine can be recommended for general pest control practices in agricultural crops. Further, since the animal urine can control some of the fungal diseases (Raja and Kurucheva, 1997). Soybean crop is heavily infested by the girdle beetle, *Obereopsis brevis* Swed. (Coleoptera: Cerambycidae). Grubs feed initially on the leaf petioles and later inside the stem. Likewise, the maggots of stem fly, *Melanagromyza sojae* Zehnter (Diptera: Agromyzidae) feed inside stem obstructing the flow of nutrients to aerial parts. The incidence of these pests was significantly reduced after spraying the crop with cow urine (15-100% conc.) and resulted in a cost: benefit ratio of 1:18.9. These results were comparable with that of chlorpyrifos 20EC at 2 ml l⁻¹ and Dipel® at 1 kg ha⁻¹, both sprayed @ 500 l ha⁻¹ (Gupta and Yadav, 2006) [5]. Transmission of plant viruses by whitefly is also common. When a 50-day old potato crop was sprayed with 10% extract of neem, *S. mukorossior* *J. curcas* and cow urine, two weeks later, the sucking pest mortality increased to 82-98% (Kumari and Chandla, 2010). Cow urine, raw or fermented, has been rarely used as a single component of pest control strategy. On the contrary, various combinations of cow urine and plant parts and neem-based commercial products have shown significant synergistic effect to enhance product toxicity resulting in pest mortality (Gahukar, 2013) [4].

Conclusion

From the above enumeration, it can be concluded that cow urine could be a potent source to improve soil fertility, crop productivity and quality. This can also be a potential alternative for fertigation which is becoming common in most of the crops. Combined with manures and fertilizer frequent use of cow urine can address many challenges of agriculture and will be pave way for sustainable agriculture. Therefore, it seems that cow urine under livestock based integrated farming system a better supplement for nutrient management. For organic agriculture nutrient management without fertilizer is a challenge. In view of the multiple benefits of using cow urine based products in agriculture cow urine is seems a very critical in this regard as more and more effective products are being prepared. Future research should focus on the interaction of other permitted inputs in organic farming with cow urine to enable integrating of cow urine for enhanced crop productivity and profitability.

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