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A study on zero budget natural farming and foliar spray on the nutritional value of oats (*Avena sativa*)

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Abstract

The present study was carried out during the *Rabi* season of 2024-2025 at the Research Farm of Himalayan University, Arunachal Pradesh to evaluate the effect of Zero Budget Natural Farming (ZBNF) practices and organic foliar sprays on the nutritional quality of oats (*Avena sativa*). The experiment was carried out using a randomized block design with seven treatments, including combinations of FYM, biomass mulching, and foliar sprays such as Panchagavya, Jeevamrut, and Beejamrut. Results indicated that the treatment with biomass mulching + Panchagavya spray (T4) significantly improved both carbohydrate (54.06%) and protein content (9.06%) in oats compared to the control and other treatments. The improvement is attributed to enhanced soil moisture retention, microbial activity, and nutrient availability. This study concludes that ZBNF-based practices, particularly the integration of biomass mulching with Panchagavya, can effectively enhance the nutritional quality of oats while promoting sustainable and low-input farming systems.

Keywords: Zero Budget Natural Farming (ZBNF), Panchagavya, Jeevamrut, Beejamrut, biomass mulching, organic farming, foliar spray.

1. Introduction

Oats (*Avena sativa* L.) is a cereal crop grown in temperate and subtropical regions during winter. Oats rank sixth in world cereal production following sorghum, wheat, maize, rice, and barley (Hoffman, 2009) [8], and contains 9.23% fat, 3.56% protein, 30.44% fibre, 0.82% calcium and 0.27% phosphorus. In India, oats is a fodder crop which is planted in *rabi* because of their increased dry matter content, 7-10% protein content, disease tolerance, and suitability for silage production (Ahmad *et al.*, 2014) [2]. Oats are mainly grown for their grains, forage, fodder, straw for bedding, hay, haylage, silage and chaff.

Oats contains higher number of protein and lipids and lesser carbohydrates than other cereals. However, starch remains the most abundant component like, comprising nearly 60% of oat grains. Starch is mostly made up of amylose and amylopectin and has characteristics such as short amylose, high crystallinity and small granule surface making it distinct from other cereal starches (Getaneh *et al.*, 2023) [6].

Zero Budget Natural Farming (ZBNF) was developed in the 1980s by Indian farmer, agricultural scientist and extension agent Subhash Palekar who established ZBNF after a period of self-study of the Vedas (the oldest of the Hindu scriptures), organic farming and conventional agricultural science, testing methods on his own farm. The phrase 'Zero Budget' refers to the aim of achieving dramatic cuts in production costs by ending dependence on external synthetic inputs and agricultural credit. It is not meant to signify 'zero costs. Instead, as practicing farmers clarify, it is meant to signify that 'the need for external financing is zero, and that any costs incurred can be offset by a diversified source of income' (ABZNF 2018 quoted in Khadse & Rosset, 2019, p. 9, emphasis added). The phrase 'Natural Farming' invokes the agroecological basis on which these cuts are to be achieved. The practice consists of four principles, referred to by ZBNF practitioners as the four 'wheels' of ZBNF. In addition to these, ZBNF farmers also reduce or avoid the application of synthetic pesticides, relying instead on homemade preparations for controlling fungus and insect pests, sourced from locally available

trees and plants such as neem, chili, garlic and tobacco (Bharucha *et al.*, 2020) ^[5].

Mulching is a technique to cover the soil surface to reduce the evaporation loss along with maintain the soil physical properties along with reduce the weed infestation (Ghouse *et al.*, 2020) ^[7]. The meaning of mulch is "soft to decay" (Jacks *et al.*, 1955) ^[9]. In comparison between the two types of mulching i.e. organic and plastic mulch; organic mulch requires lesser time to decompose in soil. After the decomposition of organic mulch in soil it enriches the soil properties. In maize mulching is an effective technique because maize is a moisture dependent cereals crop. Mulching maintains the soil temperature in the field which will be benefits for crop growth. The soil mulching reduces the weed infestation as a result; the crop can easily grow. Now a day's people are facing a huge problem to handle the crop residue. In this regards straw residue of kharif rice in rabi maize production is a good advantage for conservation agriculture and protected cultivation, which will be benefits to conserve moisture. By mulching application, the nutritional composition of seeds and as well as in stover were influenced (Awopebga *et al.*, 2017) ^[4].

Liquid formulations used in organic agriculture like panchagavya, beejamrut and jeevamrut are the fermented products which are used as plant growth enhancing substances prepared with the materials available with farmers. They are rich sources of beneficial micro-flora who stimulate the plant growth and help in getting better vegetative growth and also good quality yield. Formulations prepared from agricultural by-products viz., bran of grains oil cakes, farmyard manure etc., are excellent growth carriers and storage media (Devakumar *et al.*, 2011). During the last few years, there has been an increasing interest in the use of panchagavya, beejamrut, jeevamrut and other liquid organic manures/bio-fertilizers in organic agriculture. Devakumar *et al.* (2008) and Sreenivasa *et al.* (2010) have reported many beneficial micro-organisms viz., nitrogen fixers, phosphorus solubilizers, actinomycetes and fungi are present in jeevamrut and beejamrut (Upadhyay *et al.*, 2018) ^[13].

2. Materials and Methods

2.1 Location and experimental design

The field experiment was conducted during Rabi season of 2024-2025 at the Research Farm of Himalayan University, Jullang, Itanagar, Arunachal Pradesh. The variety used was an Indigenous variety of Oats. The experiment was laid out in Randomized Block Design (RBD) with seven treatments and three replications. The size of the plot was 3 m x 3 m with a spacing of 25 cm x 25 cm. The treatments were as follows:

Treatment	Treatment combinations
T0	Control
T1	FYM + Panchagavya spray
T2	FYM + Jeevamrut spray
T3	FYM + Beejamrut spray
T4	Biomass Mulching + Panchagavya spray
T5	Biomass Mulching + Jeevamrut spray
T6	Biomass Mulching + Beejamrut spray

2.2 Soil and Climatic Conditions

Soil type: Sandy loam with pH 4.17

Climatic conditions were typically humid-subtropical *Rabi* season.

2.3 Nutritional Analysis

Carbohydrate content was determined using Anthrone method

(Sadasivam & Manickam, 1996) and protein content was calculated using the Kjeldahl method (AOAC, 2000) with a conversion factor of 6.25 for nitrogen to protein.

3. Results and Discussion

3.1 Carbohydrate content

The highest carbohydrate content was recorded in T4 (Biomass Mulching + Panchagavya), where 5t/ha-1 straw mulch and 3ml panchagavya at 100litres water was added, showed a statistically significant increase compared to the other treatments. The probable reason for higher carbohydrate accumulation must be due to synergistic effect of biomass mulchinig, mulching influences the soil moisture conservation and improves nitrogen utilization efficiency of the crop which in turn increases the protein content in seed, combined with panchagavya spray which improves nutrient supply and supply beneficial microbial inoculants such as free- living nitrogen fixers or phosphate solubilizers. Enriching liquid formulations with rock phosphate and beneficial microbial cultures has led to an improvement in nutritive values. Similar effects were described by Rout *et al.*, (2022) ^[11], Awopebga *et al.*, (2017) ^[4] and Sugumaran *et al.*, (2024) ^[12]. The lowest carbohydrate content was recorded in T0 (Control). Possibly due to the lack of essential nutrient.

3.2 Protein content

The highest protein content was recorded in T4 (Biomass Mulching + Panchagavya), where 5t/ha-1 straw mulch and 3ml panchagavya at 100litres water was added, which showed a statistically significant increase compared to the other treatments. The probable reason for higher protein accumulation must be due to synergistic effect of biomass mulchinig, mulching greatly increased the capacity of soil to uphold the moisture contents in the topsoil and below layers as well and sufficient soil moisture and temperature are both the vital components for optimum root growth, nutrient uptake, and better soil health, combined with panchagavya spray which improves nutrient supply and supply beneficial microbial inoculants such as free-living nitrogen fixers or phosphate solubilizers. Enriching liquid formulations with rock phosphate and beneficial microbial cultures has led to an improvement in nutritive values. Similar effects were described by Mehmood *et al.*, (2021) and Sugumaran *et al.*, (2024) ^[12]. The lowest protein content was recorded in T0 (Control). Possibly due to the lack of essential nutrients.

Table 1: Carbohydrate and Protein Content of Oats

Treatment	Nutritional Value	
	Carbohydrate (%)	Protein (%)
T0 Control	50.2	6.4
T1 FYM + Panchagavya spray	52.2	7.6
T2 FYM + Jeevamrut spray	51.6	6.8
T3 FYM + Beejamrut spray	52.8	6.9
T4 Biomass Mulching+ Panchagavya spray	54.06	9.06
T5 Biomass Mulching + Jeevamrut spray	52.8	8.1
T6 Biomass Mulching + Beejamrut spray	51.9	7.2
F Test	S	S
S.Ed(±)	0.87	0.37
CD	1.91	0.80
(P=0.05)		

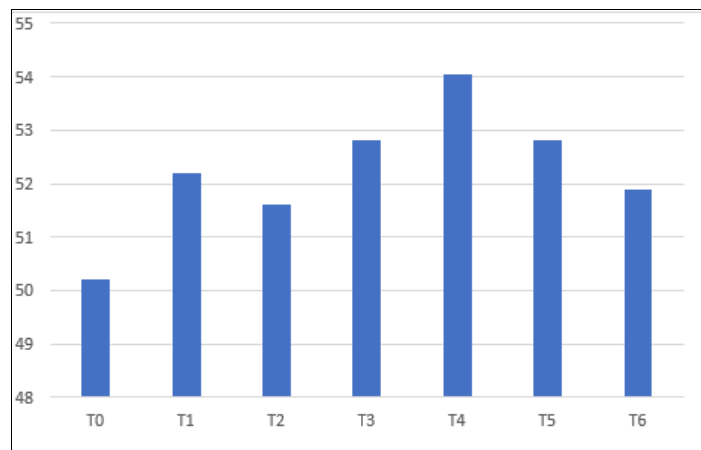


Fig 1: Graph showing effect of zero budget natural farming and foliar spray on carbohydrate content of Oats

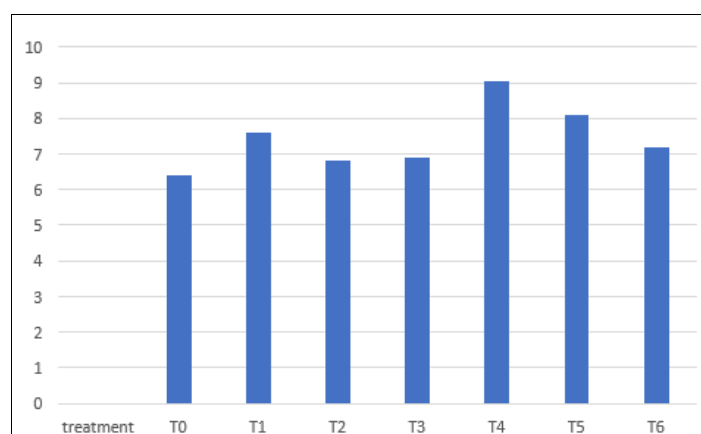


Fig 2: Graph showing effect of zero budget natural farming and foliar spray on protein content of Oats

Conclusion

Based on the study it can be concluded that the treatment T4 (Biomass Mulching + Panchagavya spray) was found to be the most effective in enhancing the nutritional content (carbohydrate and protein) in oats as compared to the other treatments. It significantly improved both parameters due to its beneficial effects on soil moisture conservation, microbial activity, and nutrient availability. The integrated application of biomass mulch with Panchagavya also supports the principles of Zero Budget Natural Farming (ZBNF) by reducing dependence on synthetic inputs while improving crop nutritional quality.

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