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Effect of Panchgavya and Jeevamrut on Yield, Chemical and Biological Properties of Soil and Nutrient Uptake by Kharif Bajra (Pennisetum Glaucum L.) Crop

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Abstract

Aim: Effect of Panchgavya and Jeevamrut on yield, chemical and biological properties of soil and nutrient uptake by Kharif Bajra (*Pennisetum glaucum* L.) Crop

Methodology: The two field experiment conducted at the Students Instructional Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) during Kharif 2023 explored the impact of various treatments on the effect of Panchgavya and Jeevamrut on the yield, chemical, and biological properties of soil, and nutrient uptake by Kharif Bajra (*Pennisetum glaucum* L.) crop replicated thrice with 09 treatments.

Results: The present study addressing environmental concern to protect plants from stress, kill pathogens and improves plant & soil health. The results indicated that T_7 Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha-1), demonstrated significantly higher growth parameters such as plant height and dry matter, higher yield attributes including effective tillers per plant (10.45), panicle length (24.46 cm), test weight (8.00 g), grain yield (44.93 q/ha), and straw yield (73.94 q/ha) with highest gross return (Rs. 1,27,113). Post harvest available soil N, P and K status and uptake was also influenced by T_7 Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @500 L ha^{-1}), Similarly, the population of bacteria, fungi and actinomycetes (14.50 cfu x 10^6 g^{-1}, 8.73 cfu x 10^3 g^{-1}, 11.30 cfu x 10^4 g^{-1}, respectively) were significantly higher after harvest as compared to other treatments.

Interpretation: The research suggested a valuable practice for farmers to adopt ecologically sound practices, to protect plants from stress, kill the pathogens, improve the plant & soil health and preserving the delicate dynamics of organic/ natural farming

Keywords: Bajra, Panchgavya, Jeevamrut, Yield.

INTRODUCTION

Pearl millet (Pennisetum glaucum L.), known as 'bajra' or 'bajri' in India, is a crucial staple crop cultivated extensively in semi-arid and arid regions across Asia and Africa. It holds the fourth position in India's cultivated area among major food grain crops, serving as a vital source of sustenance, particularly for middle and low-income families due to its affordability. Its resilience to drought, low soil fertility, and high temperatures makes it invaluable in challenging agricultural conditions. Beyond its role as a staple food, pearl millet also contributes to livestock feed, serving various purposes such as grazing, hay production, and silage. **(Patel *et al,* 2021)**

Pearl millet is rich in oil, protein, energy, calcium, and iron, making it highly nutritious. Its consumption is widespread across Africa and Southeast Asia, providing essential nutrition in regions with limited agricultural options. In India, it ranks second only to sorghum in cultivation area and production, with regional names like 'sajja' in Telugu and 'kambu' in Tamil and Malayalam. Often dubbed the "poor man's food," pearl millet plays a critical role in providing nutrition, especially during shorter growing seasons. **(Devos *et al.*,2006).**

As the most drought-resilient crop among millets and cereals, pearl millet also serves as valuable fodder for cattle and poultry. While it surpasses sorghum in nutritive value, it falls short in feeding value. Millets, including pearl millet, rank sixth globally among staple crops, with pearl millet constituting the majority of millet cultivation worldwide. Although global millet acreage has decreased slightly, Asia has seen an increase in yields, while Africa has experienced a slight decline. **(Rani *et al.*,2023).**

Pearl millet is the most widely grown type of millet. Grown in Africa and the Indian subcontinent since prehistoric times, it is generally accepted that pearl millet originated in Africa and was subsequently introduced into India. Pearl millet is well adapted to production systems characterized by drought, low soil fertility, and high temperature. It performs well in soils with high salinity or low pH. Because of its tolerance to difficult growing conditions, it can be grown in areas where other cereal crops, such as maize or wheat, would not survive. Today pearl millet is grown on over 260,000 km² worldwide. It accounts for approximately 50% of the total world production of millets. India is the largest producer of pearl millet. It is locally known as *bajra*, and is primarily consumed in the states of Haryana, Rajasthan, Gujarat and Madhya Pradesh.

Materials and Method

The field experiment was carried out at Students Instructional Farm of Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) 224229 during *Kharif* 2023. The nine treatments namely T_1 Panchgavya (2% foliar spray), T_2 Panchgavya (4% foliar spray), T_3 Panchgavya (6% foliar spray) and T_4 Jeevamrut (soil application @ 500 l ha^{-1}), T_5 Panchgavya (2% foliar spray) + Jeevamrut(soil application @ 500 l ha^{-1}) T_6 Panchgavya (4% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}), T_7 Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}), T_8 RDF (40:20:20 kg N-P-K ha^{-1}) and T_9 (Control) were comprised in RBD (Randomized Block Design) with three replications. Pearl millet variety was sown PH 1201 at 16th July. The use of panchgavya and jeevamrut at different dose in pearl millet crop. The manually sowing of crop at a spacing of 15 cm plant to plant and 45 cm row to row using seed 3.00 kg/ha.

Preparation of panchgavya

Panchgavya solution will be prepared by thorough mixing of fresh cow dung (7 kg), cow-ghee (1.0 kg), fresh cow urine (10 lit), cow milk (3 lit), cow curd (2 lit), jaggery (3.0 kg) and tender coconut water (3

lit). On the first day, 7 kg of cow dung will be thoroughly mixed with 1 kg of cow ghee and kept for 72 hours, followed by the addition of 10 lit of cow urine and 10 lit of water. The mixture was stirred twice a day and allowed to ferment for 15 days. On the 19th day, 3 lit cow milk, 2 lit cow curd, 3 kg jaggery, 2 kg banana and 3 lit tender coconut water will be added in the mixture and allowed to ferment for 7 days while stirring twice a day. The stock solution of panchgavya is ready for use after a period of 25 days.

Preparation of jeevamrut

The Jeevamrut solution will be prepared by thorough mixing of 100 lit of water, 10 kg of fresh cow dung, 10 lit of cow urine, 2 kg of jaggery, 2 kg of a pulse flour (cowpea) and 1 kg of soil from a rhizosphere area of banyan tree in barrel with the help of a wooden stick. The mixture will be stirred twice (morning and evening) in a day in a clock-wise direction and allowed to ferment for 7 days. The jeevamrut will be ready for use after a period of 7 days. Observation on plant growth, yield attributes and yield were recorded procedure. Economics was worked out on the basis of general market prices of inputs and output obtained from each treatment.

RESULT AND DISCUSSION

GROWTH

The highest plant height (174.23 cm) and dry matter accumulation(78.50) was found with the treatment T_7 Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}) which was observed to be significantly superior over the treatment T_1 Panchgavya(2% foliar spray), T2 Panchgavya(4 % foliar spray)T_3Panchgavya (6% foliar spray) and T_4 Jeevamrut (soil application @ 500 l ha^{-1}), T_8 RDF (40:20:20 kg N-P-K ha^{-1}) and T_9 Control and statistically at par with treatment T_5 Panchgavya (2% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}) T_6 Panchgavya (4 % foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}).

The increase in plant height because it contains a favourable combination of macronutrients and micronutrients , growth hormones, and bio-fertilizers in a liquid formulation. In addition, the presence of growth enzymes in Panchgavya may have encouraged quick cell division and elongation and increased the activities of beneficial microbes. The result was closely justified by the report Mushar *et al.* (2023).It has been demonstrated that applying panchgavya as a spray and jeevamrut by irrigation together improves both photosynthetic and metabolic activity, hence increasing the biological efficiency of plants. Increased nutrient absorption results from this combination approach, which promotes root penetration into deeper soil layers. As a result, this encourages the build-up of carbohydrates and leads to increased dry matter production. A similar result was reported by Patel *et al.* (2021), and (Upperi *et al.*,2009) Goveanthan *et al.* 2020.

YIELD ATTRIBUTES AND YIELD

Data on yield attributes *viz*., number of effective tillers (m^{-2}), panicle length, test weight and number of grain/panicle as influenced by different treatment are presented in Table 1 were significantly higher yield attributes *viz*., number of effective tillers (10.45), panicle length (24.26), test weight (8.00) and no. of grain/panicle(1874.00 g) were significantly higher with the Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}). The higher macronutrient and micronutrient content of the poultry manure, which enable continuous slow and steady release of nutrients coupled with panchagavya foliar spray increased the nutrient uptake, which might have helped in better tillering, finger length, grain filling, number of grains $earhead^{-1}$ (Priya and Sathyamoorthi, 2019). Similar findings were

observed by Gajjela and Chatterjee (2019),Muddassir *et al.* (2022), Gunasekar *et al.* (2018) and Panda *et al. (*2020).

Similarly, the maximum grain yield (44.93 q ha^{-1}) and straw yield (73.94 q ha^{-1}) was observed with the treatment T_7 Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}) was observed significantly superior over the treatment T_1 Panchgavya(2% foliar spray), T_2 Panchgavya(4 % foliar spray), T_3 Panchgavya (6% foliar spray) and T_4 Jeevamrut (soil application @ 500 l ha^{-1}), T_8 RDF (40:20:20 kg N-P-K ha^{-1}) and T_9 Control, statistically at par with treatment T_5 Panchgavya (2% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}) T_6 Panchgavya (4 % foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}). The minimum yield (34.17 q ha^{-1}) was observed under the treatment T_9 (control). The beneficial effect of jeevamrut cause more vigorous and extensive root system of crop leading to increased vegetative growth and improve the absorptive power of cations and anions present on soil particle and that may be released slowly during the crop growth and improvement in soil structure to existence of favourable nutritional environment under the influence of organic liquid manures which had a positive effect on vegetative and reproductive growth which ultimately led to realization of higher values for growth attributes leading to higher yield of crop. The increase grain and straw yield as well as yield attributing characters in respect to the application of organic supplements might be due to enhanced nutrient availability **(Yogananda *et al.*, 2019).** Similarly findings were observed by (Vinoth Kumar and Velayutham, 2018) and Aravind S *et al*. (2020).

Effect of Panchgavya and Jivamrut on uptake of N, P, K by pearl millet crop.

The total uptake of nutrients in the grain of pearl millet differed significantly. Higher uptake of nitrogen (62.45 kg ha^{-1}), phosphorus (25.61 kg ha^{-1}) and potassium (26.06 kg ha^{-1}) were recorded with application of T_7 Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @500 L ha^{-1}) . Lower uptake of nitrogen (39.30 kg ha^{-1}), phosphorus (16.40 kg ha^{-1}) and potassium (16.40 kg ha^{-1}) were recorded in T_9 control. Similarly, the total uptake of nutrients in straw of pearl millet nitrogen (37.31 kg ha-1), phosphorus (11.60 kg ha^{-1}) and potassium (56.19 kg ha^{-1}) were recorded with application of T_7 Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @500 L ha-1). Lower uptake of nitrogen (23.73 kg ha^{-1}), phosphorus (11.57 kg ha^{-1}) and potassium (41.79 kg ha^{-1}) were recorded in T_9 control. The uptake of nitrogen, phosphorus and potash was higher in treatments receiving more number of soil drenching of jeevamrut and Punchgabya which might be ascribed to the rapid mineralization of native and applied nutrients due to build-up of micro flora, as the microbial inoculums i.e. jeevamrut when soil drenched at different intervals, resulted in increased availability of nutrients and consequently increased the enzymatic activity and helped in increased uptake of nutrients. **Gore and Sreenivasa (2011)** reported that jeevamrut promotes immense biological activity in soil and enhance nutrient availability to crop. The results were also in conformity with work of Kaur *et al.* (2020). Similarly, **t**he increased uptake of Phosphorus may be due to the favorable influence in reducing the fixation of P and subsequently enhancing the dry matter production. The orthophosphate ion might have converted $PO4^{3-}$ to $HPO4^{2-}$ for short periods which resulted in increased concentration of P in the plants. Uptake of major nutrients increased with higher levels of organic amendments application. Higher uptake of nutrients in organic amendments applied pots might also be due to greater availability of nutrients contributed by the organic amendments. The organic manure apart from supplying major nutrients also supplies secondary and micro nutrients Channabasavanna and Shivakumar (2001). These results are in accordance with the results of Patil and Udmale (2016), who reported that application of FYM + vermicompost (50% each) +

jeevamrut (2 times i.e., at 30 and 45 DAS) gave significantly higher uptake of N, P and K by soybean. Similar findings were observed with Chaudhary *et al.(*2022).

Effect of Panchgavya and Jivamrut on soil microbial population in soil after harvest crop.

Close examination of data (Table-4) revealed that different applied treatments significantly influenced the 'MBC' activity. The maximum activity 186.70µg MBC g^{-1} soil) was observed under T_7 followed by T_6. Minimum MBC activity (107.26 µg MBC g^{-1} soil) was associated with T_9 (control). The microbial biomass and microbial activities in soil are crucial to sustain the productivity of soil. For ensuring consistent release of nutrients to the plants, there is a need to have balanced ratio of microbial biomass and activity in soil **(Pandey and Singh, 2012)** .Organic farming is reported to have enhanced both microbial biomass and microbial activity by 20-30% and 30-100%, respectively **(Stolze *et al.* 2000).** The results were also in conformity with work of **Naresh and Shukla *et al.* (2017).**

Similarly, application of **Panchgavya and Jivamrut** in combination with other inputs significantly affected the activity of soil dehydrogenase of pearl millet. The maximum activity of soil dehydrogenase (124.75µg TPF g $soil^{-1}day^{-1}$) was observed with T_7 followed by T_6. Minimum activity (85.25µg TPF g $soil^{-1}day^{-1}$) of soil dehydrogenase was associated with T_9 (control). The changed composition of the root exudates in the soybean rhizosphere may be the cause of the dehydrogenase's increased activity. The rhizosphere microorganisms are greatly impacted both qualitatively and quantitatively by root exudates. According to **Sridhar *et al.* (2014)**, the application of 120 kg N ha^{-1} of poultry manure, digested sludge, coir pith waste, press mud and FYM resulted in enhanced dehydrogenase and alkaline phosphates activity.

The population of bacteria, fungi and actinomycetes (14.50 cfu x 10^6 g^{-1},8.73 cfu x 10^3 g^{-1}, 11.30 cfu x 10^4 g^{-1}, respectively) were significantly higher with Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @500 L ha-1) (T7) after harvest as compared to other treatments. Absolute control has recorded (Table -4) significantly lower a population of bacteria, fungi and actinomycetes (6.90 cfu x 10^6 g^{-1},5.90 cfu x 10^3 g^{-1}, 7.70 cfu x 10^4 g^{-1}, respectively) after harvest. Addition of panchgavya and Jeevamrut was highly beneficial in improving bacteria, fungi and actinomycetes population in the soil which produces antioxidant enzymes, lipoxygenase, secondary metabolites, induced systemic resistance, systemic acquired resistance to protect plants from stress, siderophore production, antibiotic production, HCN production, lytic enzyme production, toxins production to kill the pathogens, nitrogen fixation resistance, phytohormone production, ACC deaminase, phosphate solubilization and potassium solubilization to improves plant & soil health. Similarly**,** Majumdar *et al.* (2006) inferred that application of urine to the soil resulted in increased micro flora in soil. It's is not only Jeevamrut and bio-digester but FYM, vermicompost and bio-fertilizers were also helpful in improving the soil micro flora population. These observations indicate that use of integrated organic sources of nutrients helped in the enhanced microbial activity and ultimately improved the soil fertility. Similarly result finding of Bhanuvally *et al.* (2014)

Economics

Data with respect to gross return for various treatments are present in Table 3. Data clearly showed that the highest gross return (Rs.127113) was obtain in T_7 Panchgavya (6% foliar spray + Jeevamrut (soil application @ 500 l ha^{-1}) followed by T_6 (Panchgavya (4 % foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1}),T_5,T_4,T_8 while T_3, T_2 and T_1 were comparable to each other and significantly associated to be higher gross return than break of the treatments. A similar result was reported by Patel *et.al* (2021), Manjunatha *et al.* (2009) and Siddappa (2016).

Conclusion

Among the various treatment, Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @ 500 lha^{-1}) found to be the good source of nutrients for Pearl Millet. growth. Combined application of Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @ 500 lha^{-1}) recorded higher yield attributes and grain yield. Hence, it is concluded that application of Panchgavya (6 % foliar spray) +Jeevamrutha (soil application @ 500 lha^{-1}) can be recommended as an effective organic source for Pearl Millet. production under irrigated condition.

S. No.	Treatment	Number of effective tillers (m^{-2})	Panicle length (cm)	Test weight (g)	No. of grain $panicle^{-1}$	Grain Yield (q ha^{-1})	Straw Yield (q ha^{-1})	Harvest Index (%)
T_1	Panchgavya (2% foliar spray)	8.35	19.80	7.22	1675.33	35.33	65.47	35.04
T_2	Panchgavya (4 % foliar spray)	8.60	20.20	7.26	1698.00	36.35	66.28	35.41
T_3	Panchgavya (6% foliar spray)	8.90	20.72	7.33	1732.00	37.00	67.15	35.52
T_4	Jeevamrut (soil application @ 500 l ha^{-1})	9.30	21.73	7.50	1788.00	38.65	67.74	36.32
T_5	Panchgavya (2% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	9.82	22.83	7.77	1822.67	40.96	70.42	36.77
T_6	Panchgavya (4 % foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	10.30	23.60	7.85	1853.00	42.65	72.76	36.95
T_7	Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	10.45	24.26	8.00	1874.00	44.93	73.94	37.79
T_8	RDF (40:20:20 kg N-P-K ha^{-1})	9.00	21.46	7.42	1784.00	37.53	67.7	35.74
T_9	Control	8.10	19.10	7.19	1669.33	34.17	64.13	34.76
SEm±		**0.24**	**0.48**	**0.27**	**28.54**	**1.42**	**1.33**	**1.10**
CD(P=0.05%)		**0.73**	**1.44**	**NS**	**85.56**	**4.27**	**3.98**	**3.30**

Table 1: Effect of Panchagavya Jeevamrut on yield attributes and grain , straw yield and harvest index of Kharif pearl millet.

Table 2: Effect of Panchgavya and Jivamrut on chemical and biological properties of soil after harvest of pearl millet crop

S. No.	Treatment	Nutrient uptake						Soil Microbial Population		
		N Uptake (Kg ha^{-1})		P Uptake (Kg ha^{-1})		K Uptake (Kg ha^{-1})		Bacteria (10^6cfug $^{-1}$ soil)	Actino mycetes (10^3cfug $^{-1}$ soil)	Fungi (10^4cfu $^{-1}$ soil)
		Grain	Straw	Grain	Straw	Grain	Straw			
T_1	Panchgavya (2 % foliar spray)	43.13	22.74	16.96	11.78	17.66	43.22	7.20	7.80	6.30
T_2	Panchgavya (4 % foliar spray)	44.07	26.51	18.54	12.59	18.52	45.07	8.60	8.50	6.50
T_3	Panchgavya (6 % foliar spray)	45.88	28.20	18.87	12.76	19.24	46.33	9.60	9.27	6.90
T_4	Jivamrut (soil application @ 500 l/ha),	49.47	31.84	20.09	13.55	21.26	48.09	11.20	9.90	7.60
T_5	Panchgavya (2 % foliar spray) + Jivamrut (soil application @ 500 l/ha)	55.70	33.80	22.52	15.49	22.53	51.73	12.50	10.20	7.70
T_6	Panchgavya (4 % foliar spray) + Jivamrut (soil application	58.58	36.38	23.88	16.00	23.88	53.84	13.70	10.80	8.30

	@ 500 l/ha)									
T_7	Panchgavya (6 % foliar spray) + Jivamrut (soil application @ 500 l/ha)	62.45	37.71	25.61	17.06	26.06	56.19	14.50	11.30	8.73
T_8	RDF (40:20:20 kg N-P-K/ha)	47.29	30.46	19.51	13.50	19.89	47.39	10.70	9.60	7.40
T_9	Control	39.30	23.73	16.40	11.57	16.40	41.79	6.90	7.70	5.90
SEm ±		**2.33**	**1.34**	**1.06**	**0.63**	**1.21**	**1.70**	**0.15**	**0.13**	**0.08**
CD at 5%		**7.00**	**4.03**	**3.20**	**1.87**	**3.62**	**5.10**	**0.45**	**0.40**	**0.24**

Table 3: Economic of each treatment combination on pearl millet.

S. No.	Treatment	Total cost cultivation	Gross Return	Net return	B:C ratio
T_1	Panchgavya (2% foliar spray)	34331	101419	67088	1.95
T_2	Panchgavya (4 % foliar spray)	35331	104131	68800	1.95
T_3	Panchgavya (6% foliar spray)	36331	105930	69599	1.92
T_4	Jeevamrut (soil application @ 500 l ha^{-1})	35081	110173	75092	2.14
T_5	Panchgavya (2% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	36541	116484	79943	2.19
T_6	Panchgavya (4 % foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	37541	121177	83636	2.23
T_7	Panchgavya (6% foliar spray) + Jeevamrut (soil application @ 500 l ha^{-1})	38541	127113	88572	2.30
T_8	RDF (40:20:20 kg N-P-K ha^{-1})	35541	107365	71824	2.02
T_9	Control	32641	98251	65610	2.01

References

1. **Devos, K.M., Hanna, W.W. and Ozias-Akins, P., (2006)**. Pearlmillet In *Cereal sand millets* (pp. 303-323). Berlin, Heidelberg: Springer Berlin Heidelberg.

2. **Gajjela, S., Chatterjee, R. (2019)** Effect of foliar application of Panchagavya and Vermiwash on yield and quality of bitter gourd (Momordica charantia L.).*International Journal of Chemical Studies* 7(3); 218-224.
3. **Goveanthan AS, Sugumaran MP, Gudimetha GK, Akila SK, Suganya K, Somasundaram E.** Studies on organic inputs (Jeevamritham and Beejamruth) and their efficacy on fenugreek. *The Pharma Innovation Journal* 2020;9(11):92-94.
4. **Gunasekar, J., Reddy, K.S., Sindhu, G.P., Anand, S., Kalaiyarasi, G., Anbarasu, M., J. Gunasekar, K. Swetha Reddy , G. Poovizhi Sindhu, S. Anand , G. Kalaiyarasi , M. Anbarasu and K. Dharmaraj1 (2018)** Effect of Leaf Extracts and Panchagavya Foliar Spray on Plant Characters, Yield and Resultant Seed Quality of Black gram *[Vigna mungo* (L.) Hepper], *International Journal of Current Microbiology and Applied Sciences* ISSN: 2319-7706 Volume 7 Number 02 (2018).
5. **Kaur, H., *Md. Shahidul Islam, Irfan Chaudhuri, Mahadee Al Mobin, Mobashara Islam, Md. Shahriar Mahmud, Md. KutubUddin, K. M. Ariful Kabir, Md. Kamrujjaman* (2020)** Physical Fitness and Exercise during the COVID-19 Pandemic: A Qualitative Enquiry. Frontiers in Psychology, 11, Article ID: 590172.
6. **Muddassir M., Raza A., Munir A., Basirat A., Ahmed M., (2022)** Antibacterial efficacy of silver nanoparticles (AgNPs) against metallo-β-lactamase and extended spectrum β-lactamase producing clinically procured isolates of *Pseudomonas aeruginosa* - Scientific Reports, 2022, 12, Article number: 20685.
7. **Mushar, R. R., Ramani, B. B., & Lakhnotra, N. K. (2023).** Response of summer pearl millet [*Pennisetum glaucum* (L.) R. Br. Emend. Stuntz] to various bio-enhancers under organic farming.
8. **Panda, D. E. B. A. S. I. S. H., Padhiary, A. K., & Mondal, S. A. N. A. N. D. A. (2020).** Effect of panchagavya and jeevamrit on growth and yield of tomato (*Solanum lycopersicum* L). *Annals of Plant and Soil Research*, *22*(1), 80-85.
9. **Patel, S.P., Malve, S.H., Chavda, M.H. and Vala, Y.B., 2021.** Effect of Panchagavya and Jeevamrut on growth , yield attributes and yield of summer pearl millet. *The Pharma Innovation Journal*, *10*(12), pp.105-109.
10. **Priya G.and Sathyamoorthi G. (2019)** Influence of Organic Manures on the Growth and Yield of Foxtail Millet [Setaria Italica (L.) Beauv] - Chemical Science Review and Letters,
11. **Rani, P., Charu, S. and Kumar, K.(2023).** Growth trend of pearl millet and its impact on Indian economy: performance analysisThe International Journal of Advanced Multidisciplinary Research and Studies *3*(3), pp.162-6.
12. **Upperi SN, Lokesh BK, Maraddi GN, Agnal MB (2009)** Jivamrut, a new organic approach for disease management and crop production in pomegranate and groundnut. Environment and Ecology.;27(1):202-204.
13. **Yogananda K.C, Easwaramoorthi Ramasamy, Vasantha Kumar S & Dinesh Rangappa (2019)** Synthesis, Characterization and dye- sensitized solar cell fabrication using potato starch nanocrystal-based gel electrolytes. Springer Link: 28:6035-8042
14. **Gore and Sreenivasa (2011)** , Influence of liquid organic manures on growth, nutrient content and yield of tomato (Lycopersicon esculentum Mill.) in the sterilized soil**.** Karnataka Journal of Agricultural Sciences 24(2)

15. Chaudhary P., Shivani Singh, Anuj Chaudhary, Anita Sharma and Govind Kumar (2022). Overview of biofertilizers in crop production and stress management for sustainable agriculture Front. Plant Sci Sec. Plant Symbiotic Interactions Volume 13
16. Majumdar, C. & G. Gupta. (2006). Applying NOAA Recommendation: A Contingent Valuation Study of Desirable Quality Water in Kolkata, India. Journal of Social and Economic Development, 8(1), 15-28
17. Manoj KN1* , Uma V 2 , Kiran SC (2014) Significance of liquid organic manures in sustainable crop production: A review. International Journal of Ecology and Environmental Sciences. 2 (4); 2020; Page No. 445-449
18. B. N. MANJUNATHA, A. S. POLICE PATIL, J. V. GOWDA, AND V. PARAMESH (2009) Effect of different system of rice intensification on yield, water requirement and water use efficiency (WUE) . Journal of crop and weed, 5(1):308-310