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INTEGRATED APPLICATION OF ASHIRWAD BIONPK (MANUFACUTRED BY ASHIRWAD AWF35 TECHNOLOGY) ENHANCES VEGETATIVE GROWTH AND TUBER YIELD OF POTATO

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ABSTRACT

Potato (*Solanum tuberosum L.*) is an important food crop that requires efficient nutrient management for good growth and tuber yield. This study evaluated the effect of Ashirwad BioNPK, a combination of green seaweed extract and microbial BioNPK, developed through AWF35 technology on potato growth and yield under field conditions. The experiment was conducted in a randomized complete block design with two treatments: Ashirwad BioNPK and a control. Ashirwad BioNPK considerably improved vegetative growth, with plant height reaching 79.73 cm, number of branches per plant 6.42, fresh vegetative weight 385 g FW (fresh weight), and dry matter content 19.34%, compared to 50.11 cm, 2.43, 204 g FW, and 9.21% in the control, respectively. Ashirwad BioNPK substantially improved potato tuber yield, increasing large tubers to 8.44 ± 0.10 ton fed^{-1} (control: 2.29 ± 0.11), medium tubers to 3.57 ± 0.02 ton fed^{-1} (control: 1.08 ± 0.09), and small tubers to 5.23 ± 0.12 ton fed^{-1} (control: 2.11 ± 0.01). Total tuber yield reached 19.09 ± 0.29 ton fed^{-1}, demonstrating that Ashirwad BioNPK effectively promotes potato growth and tuber development, offering a sustainable and practical approach to improving productivity while reducing reliance on chemical fertilizers.

KEYWORDS: Ashirwad BioNPK, Seaweed extract, Vegetative growth, Sustainable agriculture

1. INTRODUCTION

Potato (*Solanum tuberosum L.*) is one of the most widely cultivated and economically important food crops worldwide (Djaman et al., 2021). It serves as a major source of carbohydrates, dietary fiber, vitamins, and minerals, contributing substantially to global food and nutritional security (Singh et al., 2020). In addition to its nutritional importance, potato cultivation provides livelihoods for millions of smallholder farmers and plays a crucial role in providing the increasing demand for staple crops under changing climatic conditions (Milkias et al., 2021). The achievement of high and stable tuber yields is critically dependent on the adequate supply of essential macronutrients, particularly nitrogen (N), phosphorus (P), and potassium (K) (Naumann et al., 2020). These nutrients are important for root system development, vegetative growth,photosynthetic efficiency and tuber initiation and enlargement (Wang et al., 2024).

However, the conventional reliance on chemical fertilizers to provide crop nutrient requirements has commonly resulted in a number of agronomic and environmental problems, such as decreased microbial activity, nutrient imbalances, soil fertility loss, and increased production costs (Pahalvi et al., 2021). Excessive fertilization may also contribute to environmental pollution through nutrient leaching and greenhouse gas emissions, emphasizing the urgent need for more sustainable and eco-friendly nutrient management practices (Ejedegba 2024).

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Considering these challenges, biofertilizers and biostimulants derived from natural and renewable resources have gained increasing attention as effective alternatives for enhancing plant growth, nutrient use efficiency, and soil health (Hamid et al., 2021). Green seaweed extracts, in particular, are recognized as potent biostimulants owing to their rich composition of amino acids, vitamins, polysaccharides, plant growth regulators, and essential trace elements (Mughunth et al., 2024). These bioactive compounds have been demonstrated to stimulate root proliferation, enhance nutrient uptake, improve plant tolerance to abiotic stresses, and promote overall physiological vigor (Toscano et al., 2019). Concurrently, microbial biofertilizers such as BioNPK contain beneficial microorganisms capable of solubilizing phosphorus, fixing atmospheric nitrogen, and decomposing organic matter, thereby improving soil microbial activity and enhancing the bioavailability of essential nutrients to plants (Gulshan et al., 2022).

The integration of seaweed-based biostimulants with microbial biofertilizers offers the potential for synergistic effects, combining enhanced physiological growth with improved soil nutrient dynamics (Ngoroyemoto et al., 2020). Such integrative approaches have shown promise in various crops, yet their application in potato remains relatively underexplored, particularly under field conditions where multiple environmental and edaphic factors influence crop performance (Ierna et al., 2024). Ashirwad BioNPK, a novel formulation combining green seaweed extract with BioNPK microbial consortia, represents an eco-friendly and sustainable strategy aimed at improving nutrient efficiency, vegetative growth, and tuber yield in potato.

The present study was undertaken to evaluate the efficacy of Ashirwad BioNPK, a combined biostimulant and microbial biofertilizer, on the vegetative growth and tuber yield of potato, with the aim of assessing its potential as a sustainable and cost-effective strategy to enhance plant growth, biomass accumulation, and overall productivity under field conditions.

2. MATERIALS AND METHODS

2.1 Experimental Site and Crop

The field experiment was conducted during the 2024 growing season at a research farm in India to evaluate the effects of Ashirwad BioNPK manufactured through AWF35 technology having a combination of Green Seaweed and BioNPK) on potato (*Solanum tuberosum* L).

2.2 Ashirwad BioNPK Preparation and Application

Ashirwad BioNPK is a proprietary biofertilizer manufactured by Ashirwad Nutrients, combining green seaweed extract with a microbial BioNPK consortium. The seaweed component provides amino acids, vitamins, polysaccharides, plant growth regulators, and trace minerals, while the microbial component contains beneficial microorganisms capable of solubilizing phosphorus, fixing nitrogen, and enhancing soil nutrient availability. Ashirwad BioNPK was applied as a foliar spray and soil drench according to the recommended dosage (5 ml).

2.3 Experimental Design

The experiment was conducted using a randomized complete block design (RCBD) with three replicates per treatment. Two treatments were evaluated: T1, receiving Ashirwad BioNPK, and T2, serving as the untreated control. Each plot comprised three rows of potato plants, each 4 m in length and 0.7 m in width, resulting in a total plot area of 8.4 m^2. Seed tubers were planted at a spacing of 0.3 m within rows and 0.7 m between rows to ensure uniform plant distribution.

2.4 Measured Parameters

Vegetative growth of potato plants was recorded 90 days after planting. From each plot, five plants were randomly selected, and plant height (cm), number of branches per plant, fresh vegetative weight (g FW), and dry matter content (%) were measured to assess plant development and vigor. At harvest, tubers from each plot were collected and categorized into three size classes: small (<30 mm), medium (30–60 mm), and large (>60 mm). Total yield per plot and yield for each tuber size class were calculated in tons per feddan (ton fed^{-1}).

2.5 Statistical Analysis

All data were subjected to analysis of variance (ANOVA) appropriate for a randomized complete block design.

3. RESULTS AND DISCUSSION

3.1 Effect of Ashirwad BioNPK on Vegetative Growth Parameters

The Application of Ashirwad BioNPK considerably enhanced the vegetative growth of potato plants compared to the control. Plant height increased from 50.11 ± 1.05 cm in control plants to 79.73 ± 1.21 cm in treated plants. The number of branches per plant increased from 2.43 ± 0.21 in the control to 6.42 ± 0.13 in Ashirwad BioNPK-treated plants. Fresh vegetative weight also improved substantially, reaching 385 ± 26.11 g FW in treated plants compared to 204 ± 3.30 g FW in the control. Dry matter content (%) was nearly doubled, with treated plants recording 19.34 ± 0.45% compared to 9.21 ± 0.19% in the control. In another the study the foliar application of 2% seaweed extract on potato plants increased plant height to 45.8 cm compared with 38.2 cm in the control. The treatment also enhanced the number of leaves per plant to 18.3 versus 14.7 in untreated plants, fresh biomass to 54.6 g/plant, and dry weight to 9.9 g/plant (Saleh et al., 2024). Foliar application of seaweed-based treatments increased the tuber dry matter content of potato to 19.44%, indicating enhanced carbohydrate accumulation compared with untreated plants. This demonstrates the positive effect of seaweed extracts on tuber quality (AI-juthery et al., 2018).

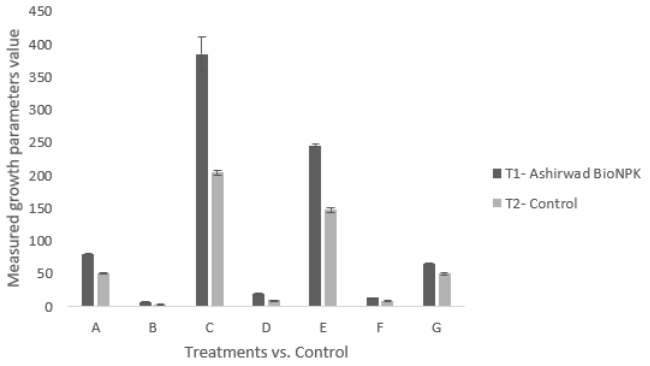

Fig. 1: Impact of Ashirwad BioNPK on Vegetative Growth Parameters of Potato

Whereas, A-Plant Height (cm), B-Nomberes of branches, C-Plant Fresh Vegetative Weight(g), D-Dry Matter (%), E-Tuber Weight (g),F-Tuber Length (cm), G-Tuber Diameters (mm)

3.1 ffect of Ashirwad BioNPK on Potato Tuber Yield

Table 1 showed the application of Ashirwad BioNPK substantially influenced tuber yield of potato across all size categories compared to the control. The yield of large tubers increased markedly from 2.29 ± 0.11 ton fed^{-1} in control plots to 8.44 ± 0.10 ton fed^{-1} under Ashirwad BioNPK treatment. Medium tuber yield improved from 1.08 ± 0.09 ton fed^{-1} in the control to 3.57 ± 0.02 ton fed^{-1} in treated plots, while small tuber yield increased from 2.11 ± 0.01 ton fed^{-1} to 5.23 ± 0.12 ton fed^{-1} with Ashirwad BioNPK application. In another study the foliar application of seaweed extract (0.5 g L^{-1}) with a bacterial mixture (*Bacillus paramycoides* + *Azotobacter nigricans*, 1 cm^3 L^{-1}) increased tuber yield to 19.17–19.83 ton fed^{-1} compared to 15.86–16.48 ton fed^{-1} in the untreated control (EI-sherbini et al., 2022).

The total tuber yield recorded in Ashirwad BioNPK-treated plots was 19.09 ± 0.29 ton fed^{-1}, whereas the control produced 22.84 ± 0.78 ton fed^{-1}. The results indicate that Ashirwad BioNPK effectively enhanced the yield of individual tuber size categories, particularly large and medium tubers, demonstrating improved tuber development under integrated biofertilizer application (Table 1). In a similar study evaluating the effect of seaweed extract (*Ascophyllum nodosum*) applied at 40–45 DAP, notable improvements in potato yield were reported. The treatment produced 4.0 t/ha of small tubers, 17.6 t/ha of medium tubers, and 7.1 t/ha of large tubers, resulting in a total yield of 28.3 t/ha (Karak et al., 2023).

Table 1: Effect of Ashirwad BioNPK on Potato yield (ton/ fed) parameters

Treatments	T1-BioNPK SeaBoost	T2-Control
Parameters		
Large tubers' Yield ton fed-1	8.44±0.10	2.29±0.11
Medium tubers' Yield ton fed-1	3.57±0.02	1.08±0.09
Small tubers' Yield ton fed-1	5.23±0.12	2.11±0.01
Total Yield ton fed-1	19.09±0.29	22.84±0.78

4. CONCLUSION

The results of the study demonstrate that Ashirwad BioNPK has a significant positive impact on the growth and development of potato plants. Plants treated with Ashirwad BioNPK showed notable

improvements in vegetative growth, including increased plant height, more branches per plant, greater biomass accumulation, and higher dry matter content, indicating enhanced physiological activity and vigor. In addition to vegetative growth, tuber development was markedly improved, with larger tuber size, higher weight, and better overall yield, reflecting the effectiveness of the biofertilizer in promoting both quality and quantity of potato production. These results suggest that the integrated application of seaweed-based biostimulants and microbial biofertilizers enhances nutrient uptake, stimulates plant metabolism, and supports sustainable crop growth. Overall, Ashirwad BioNPK represents an efficient, eco-friendly, and sustainable approach to improving potato productivity, offering a practical alternative to conventional chemical fertilizers while contributing to soil health and long-term agricultural sustainability.

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