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# Effect of Cow Dung and Vermicompost with Urea on the Vegetative Growth of *Aloe vera* in Dinajpur, Bangladesh

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**Abstract:- A pot experiment was conducted at the Department of Soil Science, Hajee Mohammad Danesh Science and Technology University, Dinajpur, Bangladesh from October 2021 to February 2022 to investigate the effect of cow dung and vermicompost with nitrogen on the biological growth of *Aloe vera*. Five treatments were used which were T1 = control (only soil), T2 = 75% soil and 25 % cow dung, T3 = 85% soil and 15% vermicompost, T4 = 90% soil, 10% cow dung and urea (30 kg ha$^{-1}$) and T5 = 80% soil, 20% and urea (30 kg ha$^{-1}$) having 4 replications. Plant growth and yield-relating data were collected 45, 75, and 120 days after planting. The significantly highest number of leaves plant$^{-1}$ (10.25), height of the *Aloe vera* plant (29.12 cm), and weight of *Aloe* leaves (97.09 g) at harvest (120 days after planting) were obtained in treatment T2, where 70% soil and 25% cow dung were used. The above-mentioned growth parameters exhibited the lowest (leaves plant$^{-1}$, plant height and weight of leaves were 6.25, 21.5 cm 44.4 g, respectively) in control treatment where only field soil was used for pot cultivation without adding manures and fertilizers (T1). Although *Aloe vera* is a leafy crop and it was supposed to urea will have a superior influence on this growth, however, cow dung with very low N can perform better for *Aloe vera* growth. Even vermicompost performed better growth than that of urea. These results suggest that *Aloe vera* is susceptible to chemical urea while growing in the Dinajpur, Bangladesh environment. Further experiments should be conducted in the field at different locations for further clarification.**

***Keywords:-*** *Aloe vera, Cow Dung, Vermicompost, Urea, Vegetative Growth.*

## I. INTRODUCTION

Despite the increasing interest in the cultivation of *A. vera* in Bangladesh, there has yet to be a comprehensive study addressing the suitability of soil under the experimental site, the requirements for organic-inorganic fertilizers, pest management, and other properties necessary for large-scale farming of this plant. Farmers are currently using their own methods of cultivation, which often result in low yields. Although *A. vera* farming has expanded across the country, there remains a significant gap in proper fertilizer recommendations for this crop. Effective fertility management in *A. vera* fields could be a key strategy for improving production.

Research has indicated that organic manures, such as cow dung and vermicompost, are more beneficial for the vegetative growth of *A. vera* than chemical fertilizers (Saha et al., 2005). Not only do these organic inputs enhance leaf quality, but they also improve the physic-chemical and biological properties of the soil. While nitrogen is typically a crucial nutrient for leafy plants, its role may differ in the context of A. vera cultivation.

The increasing focus on *A. vera* within Bangladeshi agriculture is due to its significant potential both domestically and internationally. This situation highlights the urgent need for research aimed at determining the better soil conditions and fertilizer management for cultivating *A. vera* in the region. It is essential to develop appropriate cultivation techniques and compute the pharmaceutical, nutritional, and cosmetic compounds, as well as people's perceptions concerning the economic significance of *A. vera*, to enhance its production locally. This research was undertaken to investigate the effects of cow dung and vermicompost, along with nitrogen, on the vegetative growth of *A. vera* and to assess the some plant nutrients remaining in the post-harvest soils following the application of these organic materials.

## II. MATERIALS AND METHODS

➤ *Location, Season, and Soil:*

The pot experiment was carried out at the Department of Soil Science, Hajee Mohammad Danesh Science and Technology University, located in Dinajpur, Bangladesh, during the Rabi (winter) season of 2022. Soil samples were collected from the research filed of the Department of Soil Science, HSTU, Dinajpur using an auger from 0-15 cm soil depth. The soil was analyzed for particles and was found sandy loam in texture (58% sand, 28% silt, and 14% clay). The initial soil pH measured 5.26, with an organic matter content of 0.74%. Total nitrogen was found to be 0.01%, available phosphorus was 23.0 ppm, and exchangeable potassium was recorded at 0.063 meq per 100 g of soil.

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Table 1 Leaf Number, Plant Height, and Whole Plant Weight of *A. vera* during Plantation. Data are an Average of four Replications.

| Treatments | Leaf plant$^{-1}$ | Plant height (cm) | Fresh leaf weight (g) |
|---|---|---|---|
| T1 | 5.50 | 19.50 | 46.39 |
| T2 | 5.25 | 23.25 | 51.68 |
| T3 | 5.25 | 23.37 | 48.05 |
| T4 | 5.25 | 20.47 | 48.52 |
| T5 | 5.00 | 21.60 | 46.81 |
| Average | 5.25 | 21.64 | 48.29 |

The pot size was 10 L and 8 kg total soil material was used in each pot. There are five different treatments with four replications. Those are: T1 = control (collected field soil only); T2 = 75% soil + 25% cow dung; T3 = 85% soil and 15% vermicompost; T4 = 90% soil, 10% cow dung and urea (30 kg ha$^{-1}$) and T5 = 80% soil, 20% and urea (30 kg ha$^{-1}$).

➢ *Measurements of Growth Parameters*

The height of the *A. vera* plant was measured with a one meter long wooden scale from the ground to the tip of the fully opened leaf. The plant height was recorded at 45, 75, and 120 days after planting (DAP). The number of leaves in a plant was recorded at 45, 75, and 120 DAP. After 120 DAP, whole plant leaves were harvested and weighed.

➢ *Soil Sample Analysis:*

The soil samples were collected from individual pot before starting the experiment as initial soil and after harvesting the *A. vera* leaves (at the end of the experiment). Soils were dried under shades, crushed, and sieved with a 2mm sieve and stored for analysis. Samples were stored separately in plastic containers with tags for subsequent analysis.

Soil pH was measured by using a glass electrode pH meter using 1:2.5, soil water ratio. The suspension was rested for one hour after occasional shaking before determination (Jackson, 1967). Soil organic carbon was determined by rapid titration as outlined by Jackson (1967) and the organic matter content was calculated. Total nitrogen in the soil was determined by the Semi-Micro-Kjeldahl method (Brenner and Mulvancey, 1982). Available forms of phosphorus was extracted following Olsen et al., (1954) and was determined by the molybdenum blue color method at 660 nm wavelength (Page et al., 1982). Exchangeable potassium of the soil sample was determined from the ammonium acetate extraction method using a flame photometer (Jenway PFP7, UK) as described by Page et al., (1982). Avaibale sulphur was extracted and determined by spectrophotometer following Page et al., (1982).

➢ *Statistical Software:*

The data were analyzed by using the statistical software Statistix 10.0 and mean differences were calculated at a 5% level of significance.

## III. RESULTS AND DISCUSSION

➢ *Number of Leaves*

The number of leaves plant$^{-1}$ of A. vera responded significantly due to vermicompost and cow dung with urea at different doses. The significantly highest number of leaves plant$^{-1}$ was observed in T2 (6.25, 8, and 10.25 at 45, 75, and 120 DAT respectively) (Figure 1). The lowest number of leaves plant$^{-1}$ was observed in T1 (3.75, 4.75, and 6.26 at 45, 75, and 120 DAT respectively) (Figure 1). During plantation number of leaves per plant for treatment T1, T2, T3, T4, and T5 was 3.05, 5.25, 5.25, 5.25, and 4; respectively (Table 2).

Although, the increase of leaf plant-1 did not vary among the treatments after 45 days, however, it increased significantly in T2 treatment after 120 days. At 120 DAT, the arrangement of the leaves plant$^{-1}$ was in the sequence of T2 > T3 > T5 > T4 > T1. Mengel and Kirkby (1987) and Yongabi and Babatunde (2008) also reported that nitrogen was often a restrictive factor for total biomass production in the usual ecosystem.

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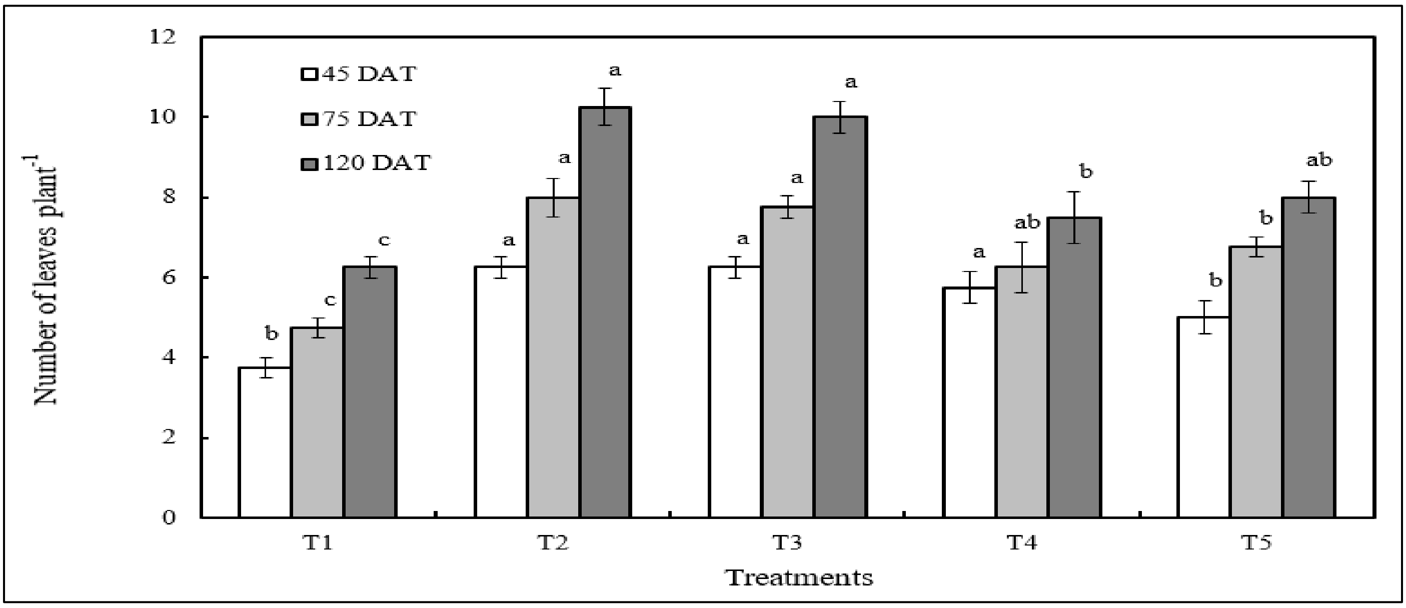


Fig 1 Effect of vermicompost and cow dung with urea on number of leaves of *A. vera* after 45, 75, and 120 days after transplanting. Data are the mean of 4 replications. Bars indicate mean ± SE. Similar color bars having different letters differ significantly. T1 = control (only soil), T2 = 75% soil and 25 % cow dung, T3 = 85% soil and 15% vermicompost, T4 = 90% soil, 10% cow dung and urea, and T5 = 80% soil, 20% and urea.

➢ *Plant Height*

Plant height of *A. vera* responded significantly due to vermicompost and cow dung with urea at different doses. Significantly highest plant height was found in T2 (24.5, 27, and 29.13 cm at 45, 75, and 120 DAT respectively) (Figure 2). The lowest number of leaves plant$^{-1}$ was observed in T1 (19.05, 19.95, and 21.5 at 45, 75, and 120 DAT respectively) (Figure 2). During plantation plant height for treatment T1, T2, T3, T4, and T5 was 18.5, 23.25, 23.37, 20.47, and 21.6 cm; respectively (Table 2). Although, the increase of leaf plant$^{-1}$ did not vary among the treatments after 45 days, however, it increased significantly in T2 treatment after 120 days. At 120 DAT, the arrangement of plant heights was in the order of T2 > T3 > T5 > T4 > T1.

*A. vera* is indicated as a succulent plant, it is more responsive to nitrogen. However, in the present experiment, it was observed that chemical urea showed a negative effect on plant height. On the other hand, organic manures showed additional effectiveness in *A. vera* growth, which almost equally effective like chemical urea fertilizer (Saha et al., 2005). Shamunnahar (2006) observed the maximum growth from organic manures because organic manures were more efficient than combinations of organic and inorganic fertilizers. It was also revealed that urea had little effect on the growth of *A. vera* over organic manures (cow dung).

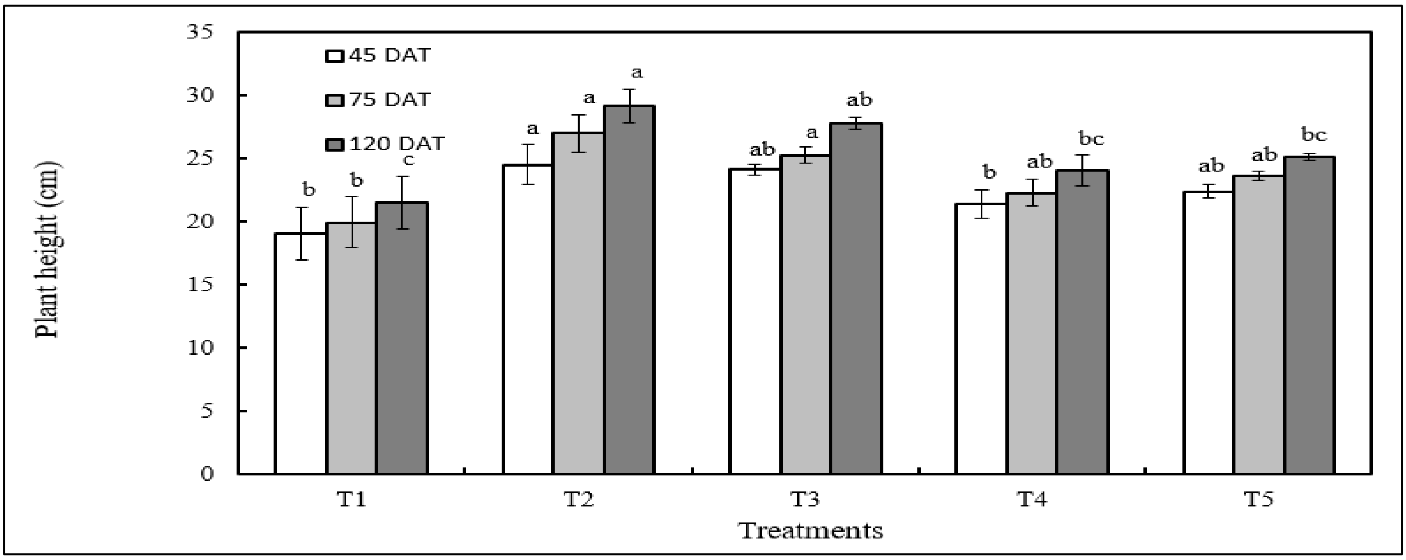


Fig 2 Effect of cow dung and vermicompost with urea on plant height of leaves of A. vera after 45, 75, and 120 days after transplanting. Data are the mean of 4 replications. Bars indicate mean ± SE. Similar color bars having different letters differ significantly. T1 = control (only soil), T2 = 75% soil and 25 % cow dung, T3 = 85% soil and 15% vermicompost, T4 = 90% soil, 10% cow dung and urea, and T5 = 80% soil, 20% and urea.

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➢ *Weight of Whole Plant*

The significant effect of vermicompost, cow dung with nitrogen has also been observed in the weight of the whole plants (Figure 3). All the treatments showed a higher weight of the whole plant over the weight recorded during planting (Table 1). The weight of the whole plant varied from 44.43 to 97.09 g. The highest weight was found in the T2 treatment (97.09 g) which was significantly close to the T3 treatment. In T2 treatment, the percentage of the weight of the whole plant was increased by 35.34% during the cultivation time. Due to low temperature, plant growth was low as physiological activity decreased. The highest significant growth was attained from cow dung because cow dung and poultry manure are more efficient than other organic manures (Ansari, 2005). The lowest weight was found in the T1 treatment (44.43 g). Although, urea is generally assumed to be highly responsive to leaf growth, however, for *A. vera* it is not the case. The unique role of nitrogen in photosynthesis, energy compounds, and important physiological processes increases the content of chlorophyll and is an indirect cause of growth and yield-enhancing factors (Aziz et al. 2007).

Results in the present experiment were in accordance with Rea et al. (2008). Mengel and Kirkby (1987) and Yongabi and Babatunde (2008) also reported that nitrogenous fertilizer is generally indicated as a restraining factor for biomass increase in the normal ecosystem. In this experiment, urea was not solely applied but applied with organic fertilizers. However, supplemental urea application with organic manures showed similar results.

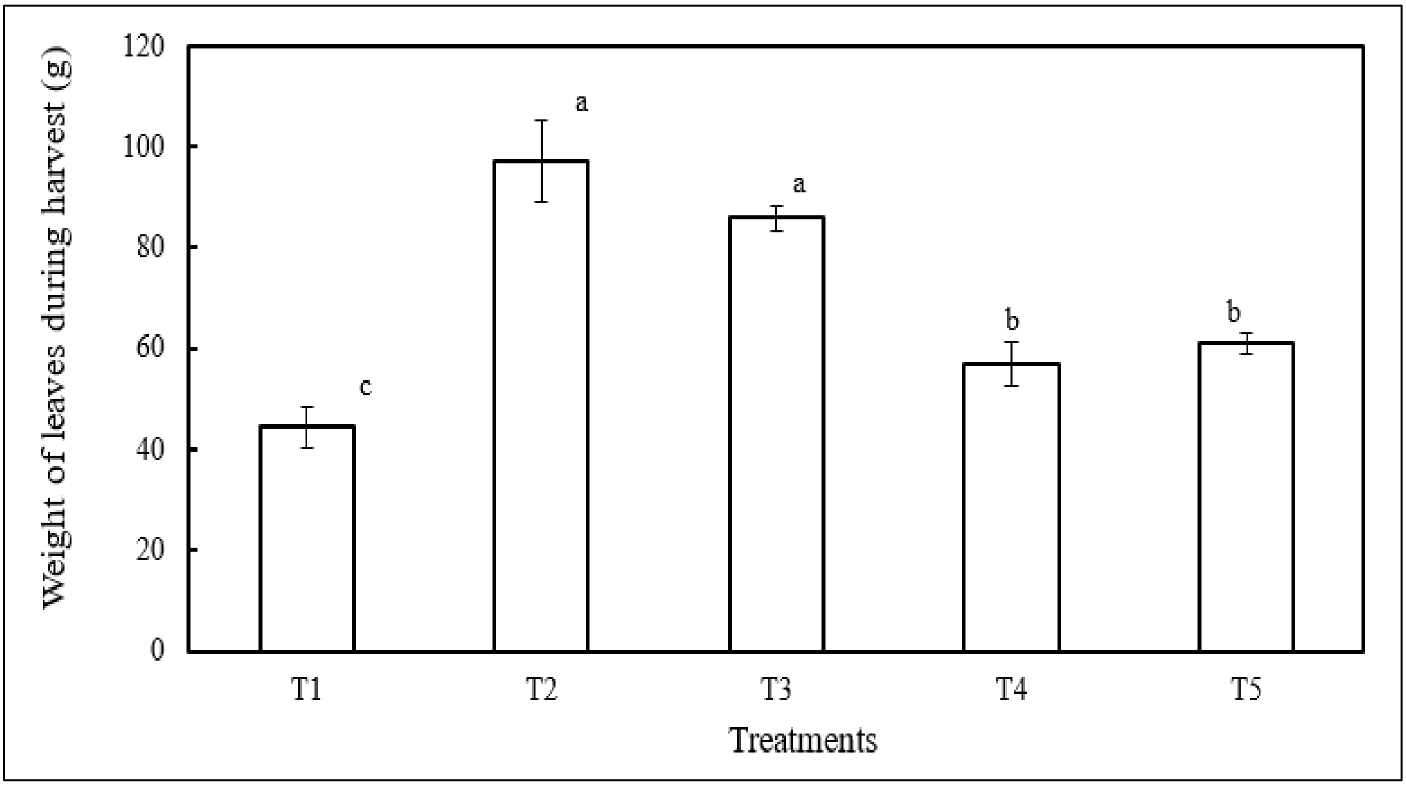


Fig 3 Effect of cow dung and vermicompost with urea on leaf yield of *A. vera* after 45, 75 and 120 days after transplanting. Data are mean of 4 replications. Bars indicate mean ± SE. Similar color bars having different letter differs significantly. T1 = control (only soil), T2 = 75% soil and 25 % cowdung, T3 = 85% soil and 15% vermicompost, T4 = 90% soil, 10% cowdung and urea and T5 = 80% soil, 20% and urea.

➢ *Chemical Properties of Post-Harvest Soils*

The pH of the post-harvest soil did not vary significantly by the different treatments of vermicompost, cow dung, and urea (Table 2). The value of post-harvest soil pH ranged from 6.3 to 6.5. The highest pH in post-harvest soil (6.5) was observed in the treatment T1 and the minimum (6.3) was observed in T3, T4, and T5.

The organic matter percentage of the post-harvest soil significantly varied with the application of different doses of cow dung, vermicompost, and urea (Table 2). Vermicompost and cow dung application increases organic matter status in soil. The average soil organic matter content in initial soil was o.74% (Table 1), which was marginally lower than the mediocre organic matter in post-harvest soils (0.76-1.92%). The highest organic matter content (1.92%) was observed in the treatment T4, whereas the lowest organic matter was recorded in the T1 treatment.

The total nitrogen of the post-harvest soil has been increased than that of the initial soil (Table 2). The total content of nitrogen in the post-harvest soils ranged 0.014% to 0.035%. The highest value of total nitrogen content in post-harvest soil was found in the T2 treatment (0.035 %). Sreelatha et al. (2006) also revealed that organic fertilizers showed positive impact on the total nitrogen of soil.

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Table 2 Effect of Vermicompost and Cowdung with N on Post-Harvest Soils

| Treatments | pH | Organic matter (%) | Total N (%) | Available P (ppm) | Exchangeable K (meq 100 $g^{-1}$ soil) | Available S (ppm) |
|---|---|---|---|---|---|---|
| Initial soil | 5.3 | 0.074 | 0.010 | 22.96 | 0.063 | 11.02 |
| T1 | 6.5 | 0.76 c | 0.014 d | 23.06 e | 0.060 b | 11.30 e |
| T2 | 6.4 | 1.19 b | 0.035 a | 26.01 b | 0.060 b | 16.58 d |
| T3 | 6.4 | 1.22 b | 0.014 d | 37.71 a | 0.065 ab | 45.22 a |
| T4 | 6.4 | 1.92 a | 0.021 c | 24.94 d | 0.067 a | 22.61 c |
| T5 | 6.3 | 1.19 b | 0.028 b | 25.76 c | 0.060 b | 32.16 b |
| LSD | 1.17 | 0.04 | 1.63 | 0.04 | 0.01 | 0.04 |
| CV% | 1.39 | 2.06 | 4.74 | 0.12 | 5.47 | 0.10 |

Available phosphorus in the initial soil was 22.94 ppm which was increased to 23.06 to 37.71 ppm after cultivating the *A. vera* (Table 1 and 2). The highest available phosphorus concentration was found in treatment T3 (37.71 ppm), whereas the lowest available phosphorus was observed in treatment T1 (23.06 ppm)

The initial soil exchangeable potassium in the experimental field was observed at 0.063 meq 100 $g^{-1}$ soil (Table 2). In the post-harvest soil, the value of the exchangeable potassium varied between 0.060 to 0.067 meq 100 $g^{-1}$ soil (Table 2). The highest value of potassium (0.067 meq 100 $g^{-1}$ soil) was found in the treatment T4. The lowest value of exchangeable potassium was observed in all other treatments (0.060 meq 100 $g^{-1}$ soil).

Available sulfur concentration in post-harvest soil varied from 11.30 to 45.23 ppm (Table 2). The maximum sulfur concentration (45.23 ppm) was obtained in treatment T3 and the lowest sulfur concentration was obtained in treatment T1 (11.30 ppm).

## IV. CONCLUSIONS

While recognized for its economic importance, particularly in the cosmetic and health industries, specific fertilizer management practices based on location have not been uniformly established. Although *Aloe vera* is a leafy crop and it was supposed to urea will have a superior influence on this growth, however, cow dung with very low dose of chemical nitrogen can perform better for *Aloe vera* growth. Even vermicompost performed better growth than that of urea. These results suggest that *Aloe vera* is susceptible to chemical urea while growing in the Dinajpur, Bangladesh environment.

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