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Effects of Nitrogen Doses on Aromatic Rice Varieties' Performance

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ABSTRACT

At the Soil Science Field Laboratory of Bangladesh Agricultural University (BAU), Mymensingh, two aromatic rice varieties, Kalizira and Chinisagar, were examined for their nitrogen needs during the Aman season. The nitrogen concentrations were as follows: N0= 0 kg ha⁻¹, N20= 20 kg ha⁻¹, N40= 40 kg ha⁻¹, N60= 60 kg ha⁻¹, and N80= 80 kg ha⁻¹. The use of nitrogen significantly improved the harvest components, grain harvest, and straw harvest of both varieties of rice. When comparing grain and straw yields, the Chinisagar cultivar was superior to the Kalizira. There was no discernible difference between the rice varieties with regard to the nitrogen concentration of grain and straw. Total nitrogen absorption was much higher in chinisagar compared to related to Kalizira species. The nitrogen application yielded a grain harvest of 1.8 t ha⁻¹ for both varieties. At 60 kg N ha⁻¹, the highest yields of 3.1 t ha⁻¹ were recorded in Kalizira, whereas in Chinisagar they were 3.2 t ha⁻¹. Both types of grain had a steady increase in yield as N treatments increased up to 60 kg N ha⁻¹, but a decline at 80 kg N ha⁻¹ and beyond. Forty kilograms of nitrogen per hectare may be the sweet spot for both varieties.

Keywords: Aromatic rice, Nitrogen doses, Varieties, Effectiveness, and Bangladesh's soils.

INTRODUCTION:

A greater emphasis has been placed on increasing rice production due to its distinctive significance in the fight against world hunger (IRRI, 2004; Bhuiyan et al., 2004). In order to fulfill their everyday food needs, farmers grow contemporary coarse grained rice. On exceptional events and holidays, they plant fragrant fine grained rice. Indeed, fragrant rice has immense popularity on both the domestic and global markets (Yoshihashi, 2005). In any case, the choice of grain quality is conditional on earners' revenue. The price of long-slender, fine-grained rice is two to three times greater than that of coarse-grained rice, while it is preferred by the well-off (Biswas et al., 1992; Sharmin et al., 2021).

According to BRRI (2004), there has been a rise in the demand for scanted fine grain rice. Approximately 27% of Bangladesh's cropped land

is devoted to fine rice varieties, while 75% of that land is devoted to rice overall (Rekabdar, 2004; BBS, 2007). Con- Demand for fine rice types in the summer is driven by improved Grains of fragrant rice are generally liked because to their nutritious value, taste, and palatability. Rice from Bangladesh comes in a variety of fragrant kinds that are perfect for steaming and other special occasion dishes like polao, biryani, jorda, and phirni. Since there are a lot of Bangladeshis in the Middle East, Europe, and the United States, some fragrant rice from Bangladesh is going there. According to World Bank (2005) and Ali et al. (2022), the demand for fragrant rice is steadily rising, both domestically and internationally. As a result of nitrogen's central role in plant development and growth, its production is dependent on precise regulation of fertilizer rates, particularly N levels (Dobermann and Fairhurst, 2000). Nitrogen promotes nutrient intake, root development, seed and leaf protein



content, and overall plant health. Chlorophyll, enzymes, nucleic acids, and amino acids all contain it. Adding nitrogen to T. aman rice has a profound effect on its development and growth. Proper growth of plants, including their subsurface components, is dependent on having an adequate supply of nitrogen (Nazimi et al., 1995). When nitrogen levels are just right, the crop thrives and yields more fruit. De Datta (1981) found that growth and development are negatively impacted by nitrogen applications that are either below or over the optimal amount. Low grain yields are common because most farmers cultivate fine grain rice without thinking about how much nitrogen to

apply (Sing et al., 1990). The growth and development of fine grain rice requires less nitrogen than coarse grain rice, according to the Bangladesh Rice Research Institute (BRRI) (2003). While data on the nitrogen needs of current coarse-grained rice crops are accessible, data on the needs of scarce fine-grained rice crops is nonexistent. Therefore, the purpose of this research was to identify the ideal nitrogen (N) level for cultivating fine-grained rice in order to maximize grain yield.

MATERIALS AND METHODS:

Research was conducted in the Soil Science Field Laboratory of Bangladesh Agricultural University, Mymensingh, from August to December 2008 during the Aman season. The motivation for the research was to find out how applying nitrogen fertilizer to fine-grained Kalizira and Chinisagar rice variety. The organic matter content of the soil is 1.92% and the pH is 6.9. There were five N levels, viz. N0 - 0 kg ha-1, N20 - 20 kg ha-1, N40 - 40 kg ha-1, and N60 - 60 kg ha-1

(60 kg ha-1) and nitrous oxide (80 kg ha-1).

For this experiment, we used two different varieties: Kalizira and Chinisagar. The experimental design consisted of a split-plot with three replications. The main plot had the various rice kinds, while the sub-plot contained the various nitrogen levels. To minimize soil hetero-genetic effects, the experimental area was partitioned into six blocks, each of which had three replications. There were five raised-ail unit plots in each

block. There were a total of 30 unit plots. A size of 4 m × 2.5 m was the unit plot. A 50 cm drain was used to divide the individual unit blocks. The treatments were assigned to the blocks at random. At 10, 40, and 60 days post-transplant, the urea was divided evenly to provide the various N rates. A starting dosage of 8 kg P, 20 kg K, and 8 kg S

Each plot was treated with 1 kg Zn ha-1 of zinc oxide, gypsum, muriate of potash, and triple super phosphate, respectively. On the same day that they were transplanted to freshly puddled unit plots, forty-day-old seedlings were carefully removed from a seedling

nursery.

The transplantation took place on August 20, 2008. There was a 15 cm x 20 cm space between each plant. Each slope was seeded with three robust seedlings. For each treatment, a uniform plant population was achieved by gap filling 7 days after transplantation. Appropriate and timely intercultural operations were carried out. Because there wasn't enough rain in October, we had to water twice more than usual. When the rice was fully mature, two different kinds were plucked. Chinisagar was harvested on December 10th, 2008, whereas Kalizira was harvested on December 3rd, 2008. After the grain and straw were harvested from each plot, they were threshed, winnowed, and dried. The samples of grain and straw that are typical were heated to 650 degrees Celsius for a period of about 24 hours prior to being processed using a grinding machine. Determined the total nitrogen content using the micro Kjeldahl technique. The nitrogen absorption was determined by calculating the value of the N content and the harvests of the crop after chemical analysis of grain and straw samples. After that, the harvest index and biological harvest were determined.



RESULTS AND DISCUSSION:

Effect of variety

Variety showed significant influence on grain and straw harvest, N content and biological harvest of rice (**Table 1**). The harvest of Chinisagar was statistically higher than that of Kalizira. The variety Chinisagar

showed highest grain (2.68 t ha⁻¹) and straw harvest, N uptake (30.4 kg ha⁻¹) and biological harvest (**Table 1**).

Asaduzzaman *et al.* (1996) observed that grain harvest increased significantly with nitrogen application. These finding are also supported by Salam *et al.* (2004). The two varieties of rice did not vary signi- ficantly in N uptake by rice grain (**Table 1**) but differed significantly in N uptake by straw. There was no significant difference in harvest index between the two varieties of rice (**Table 1**).

Table 1: Effects of variety on harvest and qualitative characters of rice.

| Variety | Grain harvest (t ha ⁻¹) | Straw harvest (t ha ⁻¹) | Grain N content (%) | Straw N content (%) | Grain N up- take (kg ha ⁻¹) | Straw N up- take (kg ha ⁻¹) | Biological harvest (t ha ⁻¹) | Harvest index (%) |
|----------------|-------------------------------------|-------------------------------------|---------------------|---------------------|---|---|--|-------------------|
| zV1: Kalizira | 2.52b | 6.66b | 1.15 | 0.60 | 29.5 | 40.7b | 9.2b | 27.4 |
| V2: Chinisagar | 2.68a | 6.84a | 1.13 | 0.63 | 30.4 | 43.8a | 9.52a | 28.2 |
| CV (%) | 6.54 | 9.47 | 7.42 | 9.17 | 8.40 | 9.6 | 6.39 | 7.69 |
| SE (±) | 0.93 | 0.10 | NS | NS | NS | 0.34 | 0.82 | NS |

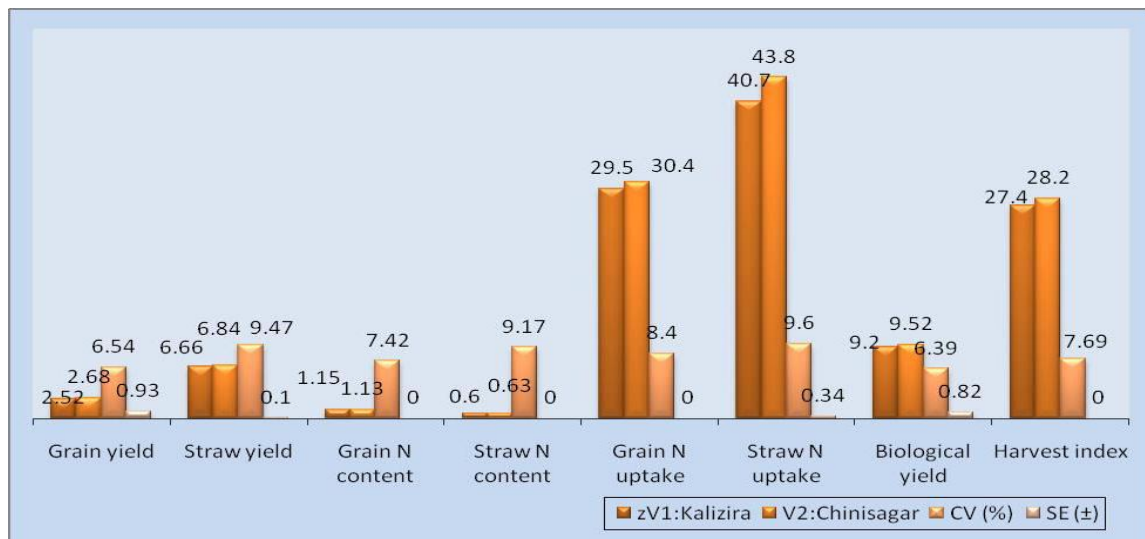


Fig. 1: Effects of variety on harvest and qualitative characters of rice.



Effect of different levels of N rates

The result revealed that all the parameters of study were significantly influenced by N rates except N content and harvest index. The highest mean grain

harvest (3.16 t ha^{-1}) was recorded in N_{60} (60 kg ha^{-1})

and the lowest harvest (1.81 t ha^{-1}) was recorded in N_0 . The application of different levels of N resulted in significant increase in straw harvest of rice (**Table 2**).

The highest straw harvest was observed 7.99 t ha^{-1} when 80 kg N ha^{-1} was applied and lowest was 5.02 t ha^{-1} over control. The effect of the rest of the N application showed statistically identical effects on straw harvest of rice. The mean biological harvest was found due to application of different levels of N fertilizer

ranged from 6.8 to 10.9 t ha^{-1} . The different levels of N application had no significant effect on the harvest index of rice. The harvest index in different levels of N

application varied from 26.2% in N_{20} (20 kg N ha^{-1})

treatment to 30.7% in N_{60} (60 kg N ha^{-1}) treatment. Nasir uddin, (2008) observed that the harvest index significantly influenced by different levels of N. He also stated that the harvest index gradually decreases

with increasing N levels. The N uptake by rice straw

was significantly affected by different rates of N application. The highest N uptake by grain (38.6 kg ha^{-1})

was obtained from N_{60} and straw (55.9 kg ha^{-1})

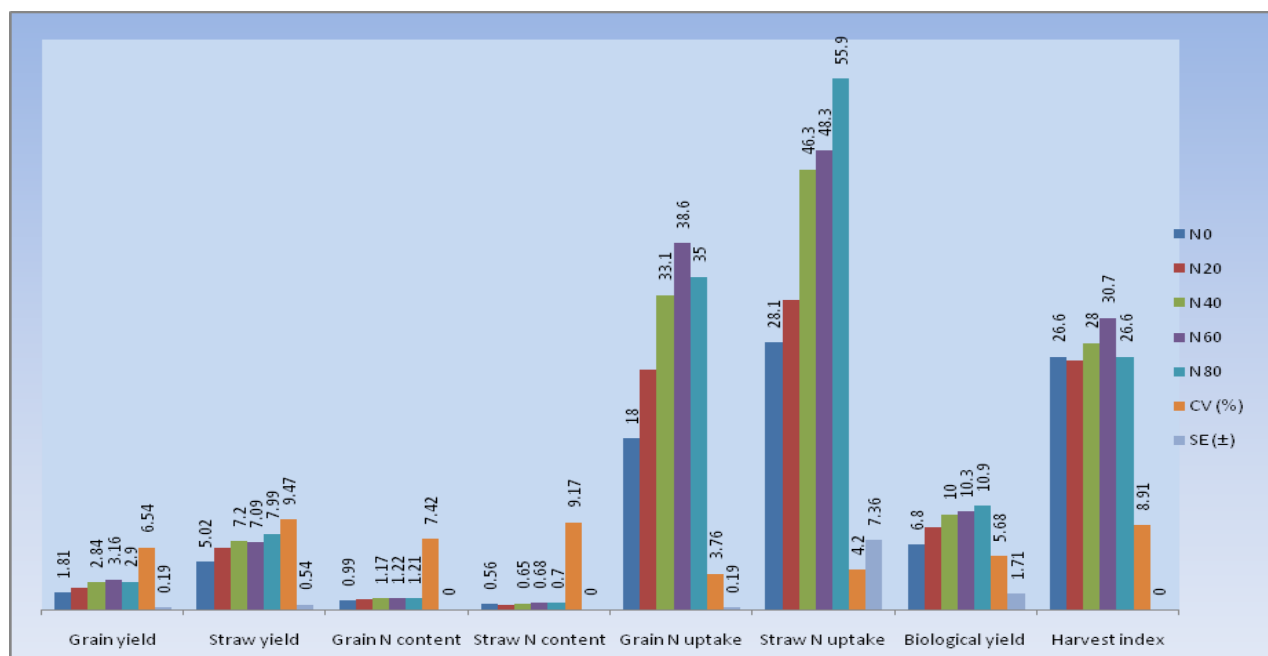
was obtained from N_{80} . The lowest N uptake (18.0 kg ha^{-1}) by grain and straw

(28.1 kg ha^{-1}) was found in N_0 . Sengar *et al.* (2000)

reported that the N uptake by rice grain and straw increased significantly with the combined application of organic manure and chemical fertilizers.

**Table 2:** Effects of N rates on harvest and qualitative characters of rice.

| N rate | Grain harvest (t ha ⁻¹) | Straw harvest (t ha ⁻¹) | Grain N content (%) | Straw N Content (%) | Grain N uptake (kg ha ⁻¹) | Straw N uptake (kg ha ⁻¹) | Biological harvest (t ha ⁻¹) | Harvest index (%) |
|-----------------|-------------------------------------|-------------------------------------|---------------------|---------------------|---------------------------------------|---------------------------------------|--|-------------------|
| N ₀ | 1.81 bc | 5.02 c | 0.99 | 0.56 | 18.0 b | 28.1 b | 6.8 c | 26.6 |
| N ₂₀ | 2.28 b | 6.46 bc | 1.11 | 0.51 | 25.2 ab | 32.6 ab | 8.7 bc | 26.2 |
| N ₄₀ | 2.84 ab | 7.20 ab | 1.17 | 0.65 | 33.1 ab | 46.3 ab | 10.0 b | 28.0 |
| N ₆₀ | 3.16 a | 7.09 b | 1.22 | 0.68 | 38.6 a | 48.3 ab | 10.3 ab | 30.7 |
| N ₈₀ | 2.90 ab | 7.99 a | 1.21 | 0.70 | 35.0 a | 55.9 a | 10.9 a | 26.6 |
| CV (%) | 6.54 | 9.47 | 7.42 | 9.17 | 3.76 | 4.2 | 5.68 | 8.91 |
| SE (±) | 0.19 | 0.54 | NS | NS | 0.19 | 7.36 | 1.71 | NS |

**Fig. 2:** Effects of N rates on harvest and qualitative characters of rice.

Interaction effect of variety and N rates

The interaction effect of variety and N rates on harvest and qualitative characters studies were highly significant except N content of rice. The interaction effect of variety and N on grain harvest was statistically significant (Table 3). The grain harvests of Kalizira

rice ranged from 1.8 t ha⁻¹ in N₀ treatment to 3.1 t ha⁻¹

with 60 kg N ha⁻¹ application. In Kalizira rice, the grain harvest increased progressively with increase in N application up to 60 kg N ha⁻¹ and then decreased with the application of 80 kg N ha⁻¹. The grain harvest of

Chinisagar rice varied from 1.8 t ha⁻¹ when no N was applied and 3.2 t ha⁻¹ with the application of 60 kg N ha⁻¹. The grain harvests of Chinisagar rice increased progressively with increase in N application up to 60 kg N ha⁻¹ and then decreased with 80 kg N ha⁻¹ application. The interaction effect of variety and N

(V×N) on straw harvest of rice was statistically significant (Table 3). In case of Kalijira rice, the straw



harvest ranged from 5.1 t ha⁻¹ without any N application to 8.3 t ha⁻¹ when 80 kg N ha⁻¹ was applied. In Chinisagar rice, the straw harvest varied from 4.9 t ha⁻¹ when no N was applied 7.8 t ha⁻¹ due to the application of 40 kg N ha⁻¹. The interaction effect of variety and N on biological harvest was significant (**Table 3**). The biological harvests of Kalijira rice ranged from 6.9 t ha⁻¹ in N⁰ treatment to 11.1 t ha⁻¹ with 80 kg N ha⁻¹ application. The inter-action effect of variety and N on the harvest index was statistically not significant (**Table 3**). In the case of Kalizira, the harvest index ranged from 24.9% in N₂₀ to 31.3% when 60 kg N was applied. On the other hand in the case of Chinisagar rice, the highest harvest index was 30.5% without any N application and lowest was 26.7% when 60 kg N applied. The interaction effect of variety and nitrogen application had no significant effect on grain-N concentration (**Table 3**).

Table 3: Interaction effects of variety and N rates on harvest and qualitative characters of rice.

| N rates | Grain harvest (t ha ⁻¹) | Straw harvest (t ha ⁻¹) | Grain N content (%) | Straw N content (%) | Grain N uptake (kg ha ⁻¹) | Straw N uptake (kg ha ⁻¹) | Biological harvest (t ha ⁻¹) | Harvest Index (%) |
|--------------------------------|-------------------------------------|-------------------------------------|---------------------|---------------------|---------------------------------------|---------------------------------------|--|-------------------|
| V ¹ N ₀ | 1.83 c | 5.10 bc | 0.98 | 0.53 | 17.9 c | 27.0 d | 6.93 c | 26.4 bc |
| V ¹ N ₂₀ | 2.18 bc | 6.54 b | 1.12 | 0.46 | 24.4 bc | 30.1 bcd | 8.76 bc | 24.9 c |
| V ¹ N ₄₀ | 2.69abc | 6.55 b | 1.18 | 0.67 | 31.8 b | 43.9 bc | 9.27 b | 29.1 ab |
| V ¹ N ₆₀ | 3.15 a | 6.80ab | 1.23 | 0.65 | 38.7 a | 44.2 bc | 9.95 ab | 31.3 a |
| V ¹ N ₈₀ | 2.81 bc | 8.33 a | 1.24 | 0.70 | 34.8 ab | 58.3 a | 11.1 a | 25.2 bc |
| V ² N ₀ | 1.879c | 4.93 c | 1.01 | 0.59 | 18.1 c | 29.1 cd | 6.72 c | 26.7 bc |
| V ² N ₂₀ | 2.38 bc | 6.38 bc | 1.09 | 0.55 | 25.9 bc | 35.1 bc | 8.76 b | 27.3 b |
| V ² N ₄₀ | 2.98 ab | 7.84 a | 1.15 | 0.62 | 34.3 ab | 48.6 abc | 10.8 a | 27.8 b |
| V ² N ₆₀ | 3.2 a | 7.37 ab | 1.21 | 0.71 | 38.5 a | 52.4 ab | 10.5 a | 30.5 ab |
| V ² N ₈₀ | 3.0 ab | 7.65 a | 1.18 | 0.70 | 35.2 ab | 53.6 ab | 10.6 a | 28.3 b |
| CV (%) | 6.54 | 21.5 | 7.42 | 9.17 | 9.40 | 8.66 | 5.68 | 8.91 |
| SE (±) | 0.26 | 0.92 | NS | NS | 0.63 | 0.34 | 1.70 | 2.09 |

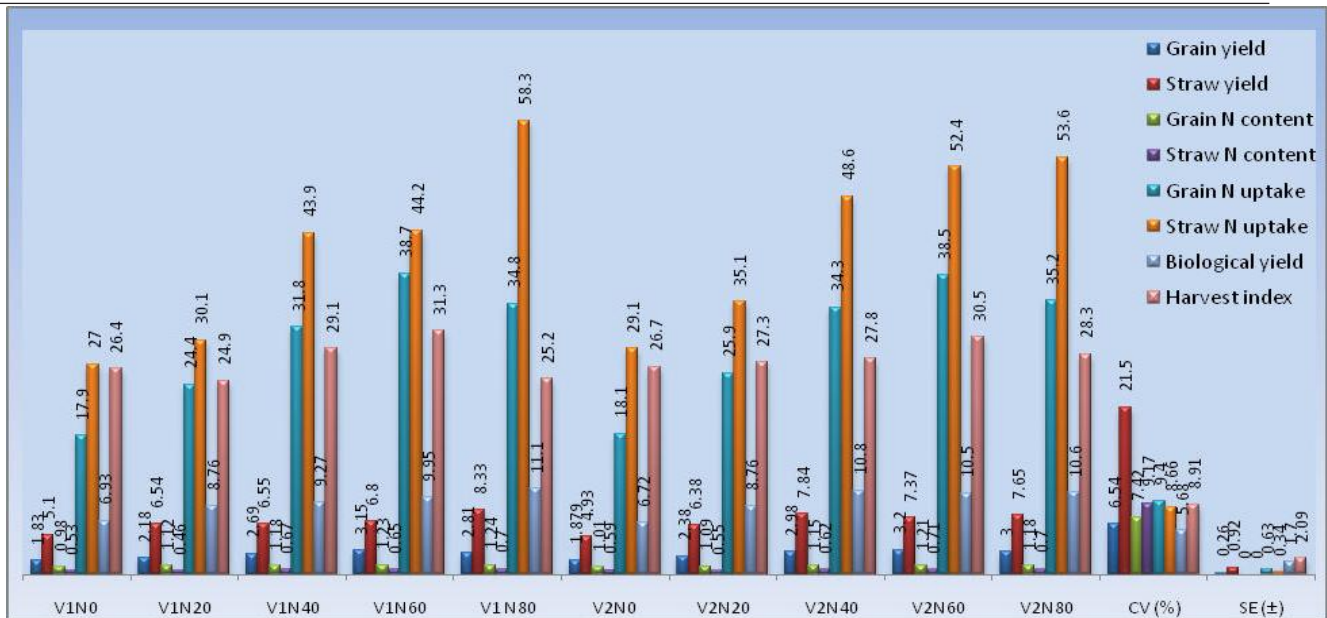


Fig. 3: Interaction effects of variety and N rates on harvest and qualitative characters of rice.

In Kalijira rice, the grain-N concentration ranged from 0.98 % in plot without any N application to 1.24 % with the application of 80 kg N ha⁻¹ while in Chini-sagar rice it varied from 1.01 % in N control treatment to 1.21 % due to application of 60 kg N ha⁻¹. A significant increase in N content in rice grain and straw due to the application of manures and fertilizers has been reported by many investigators (Verma, 1991; Jeong *et al.*, 1996 and Azim, 1999). The inter-action effect of variety and nitrogen application on N uptake by rice grain as well as straw by plant was statistically significant (**Table 3**). In the case of Kalijira rice, the application of 80 kg N ha⁻¹ produced significantly higher N uptake compared to that without N application. Similarly, in the case of Chinisagar, the significant grain N uptake was found only with the application of 60 kg N

ha⁻¹ over control treatment. Akinrinde, (2006) reported that the N application increased the N uptake by grain and straw.

CONCLUSION:

Chinisagar outperformed Kalijira in terms of total nitrogen intake, as well as grain, straw, and biological harvest. The research found that both kinds' harvest and harvest contributing characteristics were

considerably affected by nitrogen treatment. Grain yields from 40 and 60 kg N ha⁻¹ applications were statistically indistinguishable in both kinds, suggesting that 40 kg N ha⁻¹ would be ideal.

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