Leachate from Earthworm Castings Breaks Seed Dormancy and Preferentially Promotes Radicle Growth in Jute

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Additional index words. earthworm casting, seed treatment, Hyperiodrilus africanus and Eudrilus eugeniae, Corchorus olitorius

Abstract. Seeds of jute (Corchorus olitorius L.) undergo a period of dormancy, which hitherto has been broken with the conventional method of steeping in boiling water. Another seed treatment procedure, which involves soaking seeds in earthworm cast leachate, was found superior to the conventional method of breaking dormancy. Furthermore, radicle growth was enhanced when seeds were irrigated with water that contained earthworm cast leachate instead of water without earthworm cast leachate. This possibly suggests that earthworms excrete substances that contain hormones or biochemically active ingredients that are capable of stimulating root growth.

Materials and Methods

The first experiment was conducted on a seed lot of jute (cultivar NH87-C07). There were three treatments: 1) seeds steeped in hot water for 10 s, and air-dried; 2) seeds soaked for 1 h in the leachates of earthworm castings; and 3) seeds soaked for 1 h in the leachates of earthworm castings and then incubated for 24 h. The soil used in this study was collected from a forest at Ago-Iwoye (lat. 56°N, long. 4°E), and classified as Ferric luvisol and Oxic paleustalf (Smyth and Montgomer, 1962). The surface soil (0–15 cm) is well drained and contains 70% sand, 21% silt, and 9% clay, with a moisture retention of 16% at 30 kPa (Lal, 1978). The soil had 2.0% organic C, with a CEC of 12 me/100 g. The soil pH is 6.0 at a 1 soil : 2 water ratio.

Results and Discussion

Nontreated seeds did not germinate, while hot water steeping resulted in 65% germination after 7 d, indicating that dormancy was present (Table 1). Soaking seeds in earthworm cast leachate of Hyperiodrilus africanus enhanced the rate and percentage of germination in comparison with conventional hot water steeping. Earthworm cast leachate of Eudrilus eugeniae resulted in similar a response to the hot water treatment. This method is very simple and could be adopted by farmers. The earthworm cast leachate may contain enzymes or other compounds that weaken the woody seedcoat of jute, making them more permeable to water.

In the second experiment, water decanted from soil with and without worms was used to irrigate seeds. The radicle length was significantly higher for worm-water-irrigated seedlings (2.7 cm) than for soil-water-irrigated seedlings (1.0 cm) (Table 2). There were no differences in hypocotyl and leaf length or leaf width because of earthworm extracts.

Worm-water extract may contain hormones or other compounds that stimulate the root growth. Consistent with our results, Spain et al. (1992) also observed the stimulating effect of earthworms on plant growth. Lavelle et al. (1983) and Hauser (1993) found that geophagous earthworms feeding on low-quality organic matter do digest and assimilate between 10% to 20% of the ingested matter, and that even the undigested organic matter was transformed during the passage through the intestine of the worm. Martin (1991) also demonstrated that there was a 25% decrease in coarse (>50 µm) organic fraction after transmission through the worm and that 60% of the material ingested was actually assimilated. Eudrilus eugeniae has the ability to digest woody material, and has been used in the disposal of woody cassava (Manihot esculenta) peels (Mba, 1983). The earthworm cast leachate in this study may be capable of weakening the seedcoat, making it more permeable to water, hence promoting germination.

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and resulting in enhanced germination. Furthermore, earthworm exudates appear to contain compounds that are preferentially capable of promoting radicle growth.

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