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Incidence of collar rot in elephant foot yam [*Amorphophallus paeoniifolius* (Dennst.) Nicolson] as influenced by varied nutrient regimes in East and South-eastern coastal plain zone of Odisha

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ABSTRACT

A field experiment was conducted at Regional Centre of Central Tuber Crops Research Institute, Bhubaneswar for consecutive two years (2011 and 2012) to study the collar rot incidence under varied fertility levels and its influence on tuber yield. The highest collar rot incidence was noticed in the treatment T_7 (16.11%) viz. FYM 10 t ha^{-1} + 100-60-100 N-P_2O_5-K_20 kg ha^{-1} *and least was recorded in the treatment T_8 (10.59%) viz.* FYM @ 25 t ha^{-1}. *The former treatment also recorded significantly more corm yield, thus justifying integrated use of FYM and fertilizer. Sole application of FYM @ 25 t ha^{-1} produced 36.1 t ha^{-1} which was at par with the other mentioned treatment (37.65 t ha^{-1}). The treatments comprising of only NPK fertilizers viz.* 80-60-80 N-P_2O_5-K_20 kg ha^{-1} *(T_3)* and 100-60-100 N-P_2O_5-K_20 kg ha^{-1} *(T_4) also recorded significantly more yield over control.*

Keywords: Collar rot incidence, corm yield, elephant foot yam, fertility levels

Root and tubers are the most important food crops since time immemorial in the tropics and subtropics (Behera *et al.*, 2009). Elephant foot yam (*Amorphophallus paeoniifolius* (Dennst.) Nicolson) is regarded as "King of tuber crops" due to its higher biological efficiency as a food producer and possesses higher productivity in a short growing season as well as confers high returns (Mukhopadhyay and Sen, 1999; Nath *et al*., 2007; Nedunchezhiyan, 2014). The crop is susceptible to *Sclerotium rolfsii* Sacc. which causes collar rot, a destructive disease often afflicting heavy loss to the crop (Sivaprakasam *et al*., 1982). Since, *S. rolfsii* is a non- specialized soil borne fungal pathogen of world-wide importance and has a host range of over 500 species management of this pathogen is extremely ambiguous. The pathogen, *S. rolfsii* is distributed in tropical and sub-tropical regions of the world where high temperatures prevail. The fungus has a wide host range of 500 species in about 100 families including groundnut, green bean, lima bean, onion, garden bean, pepper, potato, sweet potato, tomato and water melon (Aycock, 1966). It is more destructive during rainy season followed by warm dry weather. Injury to collar region during intercultural operation, poor drainage and water logging acts as predisposing factors for infection by *S. rolfsii*. Soft and tender pseudostems are more vulnerable to this disease. Hence, the present investigation was designed to incur the data regarding effect of varied nutrient regimes on incidence of collar rot and its subsequent effect on yield of elephant foot yam.

MATERIALS AND METHODS

The field experiment was carried out for consecutive two years during 2011 and 2012 at Regional Centre of Central Tuber crops Research Institute (20°14'53.25'' N and 85°47'25.85''E and 33 m above mean sea level), Dumduma, Bhubaneswar, Odisha, India. Texturally the soil was sandy loam with neutral soil reaction (pH 6.7). The soil type of experimental site was alfisols and comes under the family "Typic Rhodustalfs". The initial soil fertility status of the experimental site was 0.3 per cent organic carbon, 91.5 kg ha^{-1} available nitrogen, 14.9 kg ha^{-1} available phosphorus and 235.7 kg ha^{-1} available potassium. The mean maximum and minimum temperatures ranged between 29.4-38.3°C and 15.4-26.6°C respectively and mean maximum and minimum relative humidity varied in between 61.5-90.7 per cent. The average rainfall was 1273.9 mm and precipitation was higher during June to September over both the experimental years. An average of 90 rainy days was recorded during the cropping period.

The experimental land measuring (36 ×13.5m) was ploughed and pulverized 2-3 times by tractor driven mould board plough followed by laddering to obtain a fine tilth. Stubbles and weeds were removed from the field. The experimental plot was divided into 24 plots with eight plots per row. Each plot measuring 4.5 × 4.5m, having 50 cm wide irrigation cum drainage channel between each plot was laid out. Corms to be planted were treated with slurry made from fresh cow dung (10 kg cow dung in 10 litres of water). The corms soaked

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for 15 minutes, were dried under shade for 24 hours to avoid collar rot and decay after planting to evade possible presence of several soil borne pathogens. After proper drying, the corms were planted on the ridges or hills with plant to plant spacing of 75 cm and ridge to ridge spacing of 75 cm. The experiment was laid out in randomized block design with three replications. The experiment comprised of eight treatments viz. T_1- Control, T_2 - 60-60-60 N-P_2O_5-K_20 kg ha^{-1}, T_3 - 80-60-80 N-P_2O_5-K_20 kg ha^{-1}, T_4 - 100-60-100 N-P_2O_5-K_20 kg ha^{-1}, T_5 - FYM 10 t ha^{-1} +60-60-60 N-P_2O_5-K_20 kg ha^{-1}, T_6 – FYM @ 10 t ha^{-1} +80-60-80 N-P_2O_5-K_20 kg ha^{-1}, T_7 - FYM 10 t ha^{-1} + 100-60-100 N-P_2O_5-K_20 kg ha^{-1} and T_8 – FYM @ 25 t ha^{-1}. Full P was applied as basal dose during the final ploughing and 1/3rd of N and K were applied in two equal splits at one and two months after planting. The FYM used in this experiment contained 0.54 per cent N, 0.32 per cent P and 0.48 per cent K.

The collar rot incidence was recorded after 2 months of planting till it attained harvest maturity. The growth attributes *viz*., plant height and spread, pseudostem diameter were measured at 5 months after planting because plant showed senescence (yellowing) afterwards. Yield attributes and yield were recorded at harvest. The data were analysed statistically by following the standard procedure (Panse and Sukhatme, 1976).

RESULTS AND DISCUSSION

The result of the two years investigation on the effect of different fertility levels on days to sprouting has been presented in table 1. It is evident from the table 1 that days to 100 per cent sprouting of the elephant foot yam cv. Gajendra attained a faster rate in treatment T_7 closely followed by T_8 and T_6. This might be due to addition of farm yard manure (FYM) which activates physiological process for sprouting of tubers.

The data on growth attributes are presented in table 1. Higher plant height and canopy spread was observed with T_8 and was statistically *at par* with T_7 and T_6. Pseudostem diameter was maximum in T_7 and it was statistically at par with T_8 and T_6. This indicates that higher the fertility level higher are the growth attributes. Similar results of increased pseudostem height for higher levels of inorganic fertilizers (N, P and K) in taro have been realized by Bhuyan and Quasem (1983) and Rahman and Rashid (1983). The results also imply that FYM increased the growth attributes when applied along with fertilizers. FYM alone also leads to better growth attributes if applied at optimum levels.

Collar rot incidence was meagre when only FYM was applied or no FYM and fertilizer were applied. The treatment T_8 resulted in significantly lowest collar rot incidence. This may be due to build up of more number of disease controlling microbial population when only FYM was applied which may be arresting collar rot spread. The treatment T_1 was the next best treatment. Native disease controlling microbes and sturdy pseudostem may be preventing the collar rot incidence when no fertilizer and FYM were applied. The treatment T_7 resulted in higher incidence of collar rot. This might be due to higher amount of inorganic fertilizer application. Higher amount of inorganic fertilizers suppresses the growth of disease controlling soil micro organism and favours multiplication of *S. rolfsii*.

The effect of differential fertility levels on the yield and yield attributes on elephant foot yam as depicted in table 1 through pooled mean data for both the subsequent years of investigation revealed that treatment T_7 resulted in highest corm diameter closely followed by T_8, T_6 and T_5. Minimum corm diameter was observed in T_1 (control). The ranges of corm diameter values were in accordance with Das *et al*. (1997). The treatment T_7 also exerted its significant influence on the corm yield per plant with highest corm yield of 2150 g followed by T_8 (2060g) and T_6 (2020 g). As expected, elephant foot yam plants having no fertility supplements *i.e*. T_1 (control) produced the lowest corm yield (1045 g). The corm yield increased gradually with increase in fertility levels. The increase in corm yield was about 97.12 % (T_8) and 105.74% (T_7) over control (T_1). Higher corm yield in T_7 and T_8 may be ascribed to early sprouting, higher plant height and canopy spread which could provide higher photosynthesis and better translocation of photosynthates from source to sink, resulting in higher corm weight. The treatments comprising of only NPK fertilizers (T_3 and T_4) also recorded significantly more yield over control. However, the corm yield did not change appreciably at lower doses of N-P_2O_5-K_2O @ 60-60-60 kg ha^{-1} (T_2). The positive responses were only obtained above the dose of N-P_2O_5-K_2O @ 60-60-60 kg ha^{-1}. Similar results were also reported by Chattopadhyay and Nath (2007), Saravaiya *et al*. (2010) and Suja *et al.* (2010).

Table 1: Effect of varied nutrient regimes on growth attributes, collar rot incidence and yield attributes and yield of elephant foot yam (pooled of 2 years).

Treatments	Days to sprouting (%)	Plant height (cm)	Canopy spread (cm)	Pseudo stem diameter (cm)	Collar rot incidence (%)	Corm diameter (cm)	Corm yield (g plant^{-1})	Corm yield (t ha^{-1})
T_1	58.8	88.3	86.2	10.9	11.33	19.55	1045	18.3
T_2	57.0	90.4	88.3	11.2	11.88	20.60	1390	24.3
T_3	57.0	92.9	92.0	11.6	12.27	21.60	1555	27.2
T_4	57.1	95.1	92.1	12.7	15.21	23.0	1695	29.6
T_5	56.1	100.9	96.6	12.9	15.42	23.40	1845	32.3
T_6	55.3	103.7	99.6	13.1	15.72	24.50	2020	35.4
T_7	53.7	107.2	102.0	13.9	16.11	25.55	2150	37.6
T_8	53.8	110.5	106.4	13.6	10.59	24.65	2060	36.1
SEm (±)	**0.71**	**3.33**	**2.85**	**0.38**	**1.02**	**0.860**	**154.18**	**2.65**
LSD (0.05)	**2.1**	**9.7**	**8.3**	**0.8**	**2.2**	**2.518**	**451.30**	**7.7**

***Note**: T_1- Control, T_2 - 60-60-60 N-P_2O_5-K_20 kg ha^{-1}, T_3 - 80-60-80 N-P_2O_5-K_20 kg ha^{-1}, T_4 - 100-60-100 N-P_2O_5-K_20 kg ha^{-1}, T_5 - FYM 10 t ha^{-1} +60-60-60 N-P_2O_5-K_20 kg ha^{-1}, T_6 – FYM @ 10 t ha^{-1} +80-60-80 N-P_2O_5-K_20 kg ha^{-1}, T_7 - FYM 10 t ha^{-1} + 100-60-100 N-P_2O_5-K_20 kg ha^{-1} and T_8 – FYM @ 25 t ha^{-1}.*

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