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Short Communication

Efficiency of Spent *Pleurotus* Mushroom Substrate on Growth of Sorghum (*Sorghum bicolour* (L.) Moench)

P. Veera Lakshmi[1] and K. Parani*[2]

[1-2] P. G. and Research Department of Botany, Sri Parasakthi College for Women (Autonomous), Courtallam - 627 802, Affiliated to Manonmaniam Sundaranar University, Abhishekapatti, Tirunelveli (District), Tamil Nadu, India

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Sorghum (*Sorghum bicolour* (L.) Moench) is a plant belonging to the family of grasses (Poaceae). Sorghum is well adapted to tropical and subtropical climates, but the greater part of the area of the crop falls in drought – prone, semi – arid tropical regions of the world. In these harsh environmental conditions Sorghum is predominantly grown for human consumption followed by animal feed and fodder. Sorghum could also play an important role in its alternate uses in brewing industry for the production of ethanol, starch and syrup [1]. Agricultural wastes are rich in various types of nutrients and their disposal is different to manage as excess of nutrients in them can cause leaching is left in field, as a compost. Mostly they are disposed by means of incineration which causes pollution [2]. Hence there is always a high demand of discovering an agricultural waste management method which is cost effective and contribute less in environment pollution. Mushroom cultivation on agricultural wastes fulfils these requirements [3].

Oil palm (*Elaeis guineesis*) belong to family Palmae and tribe Cocoineae oil is extracted from both the pulp of fruit and kernel [4]. Palm oil is one of the major agricultural commodities in the world and is therefore, one of the largest agricultural industries. Availability of mesocarp fibre is due to the activities of palm oil mills. Hence it will be of interest to utilize mesocarp fibre for the cultivation of mushroom. For this reason, there is need to have constant to supply of the substrates which is readily available with low-cost price rather than depend on specific types of materials or some seasonal forest supply for cultivation of mushroom [5]. According to Sreekala *et al*. [6] mesocarp fibre are left as a waste material after oil extraction, creating great environmental problems. Therefore, economic utilization of these fibres will be beneficial to the commercial cultivators and the country as a whole. Keeping in view, the present study was focused to study the stimulatory effect of spent mushroom substrate (SMS) as an organic ameliorant for the growth of *Sorghum bicolour* in pot studies.

Raising of cultivar

Seeds of sorghum was purchased from local market in Rajapalayam, Virdhunagar District, Tamil Nadu. Healthy and viable seeds of Sorghum was surface sterilized with 0.1% mercuric chloride for one minute and washed with running tap water, followed by rinsing with distilled water. The seeds were soaked in distilled water for overnight and sown in pots containing uniformly mixed garden and sandy soils in 1:1 ratio as control, whereas experimental sets viz., Spent *Pleurotus* Mushroom Substrate + soil, spent *Pleurotus* mushroom substrate cocultured with isolate bacterial strain 5, Oil palm mesocarp + mushroom + Isolate bacterial strain 6 degraded waste were analyzed for their growth of sorghum seedlings.

The treatments were T_0 = control (only soil), T_1 = soil + spent *Pleurotus* mushroom substrate, T_2 = soil + spent *Pleurotus* mushroom substrate with bacterial isolate 5, T_3 = soil + spent *Pleurotus* mushroom substrate with bacterial isolate 6. Pots were placed in open field, and no other organic or inorganic fertilizer used in growing media. Growth promotion was recorded on 2 week and 4^{th} week of intervals after transfer of plants in terms of plant height in comparison to the control sets as germination percentage (%), root length and shoot length (cm) and height of the seedlings were calculated.

Effect of SMS on morphological indicators of sorghum seedlings. As can be seen from (Table 1) germination of sorghum seeds. Data regarding the germination of seeds in different treatments of SMS. Among all the treatments was analyzed in that highest percentage of germination was observed in T_3 spent *Pleurotus* mushroom substrate + Bacterial isolate I_6 (92%) followed by T_2 spent *Pleurotus* mushroom substrate + Bacterial isolate I_5 showed 86% of germination respectively. Only spent mushroom substrate T_1 mixed with soil in ration of 1:1 has recorded 70% of germination and oil palm mesocarp waste alone T_5 as substrate observed 82% of germination. The lowest percentage was seen in control T_0 (only soil) has 56% of sorghum seeds were germinated respectively. The highest production of seedling vigour index

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Correspondence to: K. Parani, P. G. and Research Department of Botany, Sri Parasakthi College for Women (Autonomous), Courtallam - 627 802, Affiliated to Manonmaniam Sundaranar University, Abhishekapatti, Tirunelveli (District), Tamil Nadu, India; E-mail: paranik@sriparasakthicollege.edu.in

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(2,143) was observed in T_3 spent *Pleurotus* mushroom substrate + Bacterial isolate I_6 and lowest production of 638 seedling vigour index was seen in T_0 control as soil alone. Similar results are explained the longer time of germination to adjust the fertility of substrate and improve its properties as a substrate to produce tomato seedlings [7] and seedlings produced in organic substrates had greater diameter of the colon, indicating a higher quality of the seedlings after transplanting [8].

Table 1 Effect of different treatments of SMS on germination of *Sorghum bicolor*

Treatments	Number of seeds sown	Germination of seeds	% of germination	Seedling vigour index
T_0: Control (Soil)	50	28	56	638.4
T_1: Spent *Pleurotus* mushroom substrate	50	35	70	1,190
T_2: Spent *Pleurotus* mushroom substrate + bacterial isolate I_5	50	43	86	1,737
T_3: Spent *Pleurotus* mushroom substrate + bacterial isolate I_6	50	46	92	2,143
T_4: Oil palm mesocarp waste + Soil	50	33	66	1,029
T_5: Oil palm mesocarp waste alone	50	41	82	839

Root length and shoot length

Data regarding the effect of spent mushroom substrate on root and shoot length are shown in (Table 2-3). The results obtained from the growth parameters of sorghum seedlings were studied on T_3 spent *Pleurotus* mushroom substrate + Bacterial isolate I6 recorded the highest growth in both shoot and root length i.e., 6.0 and 8.8 cm on 2nd week of seedlings and 8.5 and 14.8 cm on 4th week of seedlings respectively. This was followed by T_2 spent *Pleurotus* mushroom substrate + Bacterial isolate I5 in that the shoot length and root length was grown up to 5.9 and 7.5 cm on 2nd week and 7.6 and 12.6 cm on 4th week as slightly decreased. The growth rate was lowered as in seen T_5 OPMW alone i.e., shoot and root length recorded 2.3 and 4 cm on 2nd week and 3.4 and 6.8 cm in 4th week of seedlings. Average growth was observed T_4 combination of soil + oil palm mesocarp waste. From the present study, spent mushroom substrate exerted a significant influence on root length of Sorghum (Table 2 and 3). These results are reported that spent mushroom waste exerted a significant influence on root length of Kailan (*Chinese brococoli*) at harvest [9]. Addition of suitable organic manure improves the soil physical and chemical properties which encourage better root development, increased nutrient uptake and water holding capacity which leads higher fruit yield and better fruit quality [10].

Table 2 SMS treatments on growth parameters of *Sorghum bicolour* at 2 weeks interval

Treatments	Shoot length	Root length	Total height of seedlings
T_0: Control (Soil)	4.7 cm	5.3 cm	8.5 cm
T_1: Spent *Pleurotus* mushroom substrate	6 cm	5.3 cm	11.3 cm
T_2: Spent *Pleurotus* mushroom substrate + bacterial isolate I_5	7.5 cm	5.9 cm	13.4 cm
T_3: Spent *Pleurotus* mushroom substrate + bacterial isolate I_6	8.8 cm	6.0 cm	14.8 cm
T_4: Oil palm mesocarp waste + Soil	6.4 cm	4.6 cm	11 cm
T_5: Oil palm mesocarp waste alone	4 cm	2.3 cm	6.3 cm

Table 3 SMS treatments on growth parameters of *Sorghum bicolour* on 4 weeks interval

Treatments	Shoot length	Root length	Total height of seedlings
T_0	6.9 cm	4.5 cm	11.4 cm
T_1	10.2 cm	6.8 cm	17 cm
T_2	12.6 cm	7.6 cm	20.2 cm
T_3	14.8 cm	8.5 cm	23.3 cm
T_4	9.7 cm	5.9 cm	15.6 cm
T_5	6.8 cm	3.4 cm	10.2 cm

Table 4 SMS treatments on weight of *Sorghum bicolour* seedlings

Treatments	Fresh weight	Dry weight	Moisture content
T_0	11.7	4.8	6.9
T_1	17	9.4	7.6
T_2	21.2	15.3	5.9
T_3	23.4	15.8	7.6
T_4	15.6	6.7	8.9
T_5	10.2	3.9	6.3

Fresh and dry weight

Data regarding the fresh and dry weight of sorghum seedlings were recorded in (Table 4). Both fresh and dry mass of plant differed significantly between treatments. Among them, Sorghum seedlings produced the highest fresh and dry mass was observed in treatment T_3 spent *Pleurotus* mushroom substrate + Bacterial isolate I^6 has produced 23.4g of fresh wt. and 15.8 g of dry weight respectively and slightly decreasing fresh and dry weight in T_2 Spent *Pleurotus* mushroom substrate + Bacterial isolate I_5 (21.5g and 15.3g) were recorded. Only T_1 spent mushroom substrate compare to coculture slight variation as showed 17 g fresh weight and 9.4 g dry weight. The lowest weight of fresh and dry mass was recorded in only T_5 oil palm mesocarp waste (10.2 g and 3.9g). Our results are reported that SMS compost of *Pleurotus* mixed with depleted garden soil generally enhanced all the variables of growth considered when compared with control [11-12]. Similarly, that composted spent mushroom substrate mixed with loamy soil produced greater vegetative growth and yields of vegetables [13] and that SMC could be used to improve growth and yield of maize [14]. In this present study, the increase in the fresh mass of sorghum with an increase in spent mushroom substrate supplied to improve nutrient availability and soil structure as their by release of nutrients. The increase in fresh weight could be ascribed to the fact that several living organisms are activated in soil with addition of organic matter and these organisms promote the absorption or nutrients from the soil and stimulate plant growth as a result released phyto-hormones in the soil.

The spent mushroom substrate has been analyzed and found to be nutritionally rich with respect to its N:P:K contents and high cation exchange capacity [15-18]. Therefore, it has the ability to replace inorganic Farm yard manure for the purpose of raising horticultural and cereal crops, as feeding material for vermicomposting, for plants disease management, preparation of organic mineral fertilizer and bioremediation of the contaminated soils [19-21].

SUMMARY

In the present study revealed that the effect of SMS on morphological indicators of sorghum seedlings. The highest percentage of germination (92%), shoot and root length i.e., 6.0 and 8.8 cm on 2nd week and 8.5 and 14.8 cm on 4th week of seedlings were observed in T_3 spent *Pleurotus* mushroom substrate + Bacterial isolate I_6 respectively as compared to other treatments. The lowest germination percentage 56% was seen in control T_0 (only soil). The growth rate also lowered as in seen T_5 oil palm mesocarp waste substrate alone i.e., shoot and root length recorded 2.3 and 4 cm on 2nd week and 3.4 and 6.8 cm in 4th week of seedlings. Both fresh and dry mass of plant differed significantly between treatments. To conclude that the SMS of *Pleurotus sajor- caju* of an excellent substrate for the production of sorghum seedlings, as it provides the formation of vigorous and quality seedlings. To conclude that the SMS of *Pleurotus sajor- caju* of an excellent substrate for the production of sorghum seedlings, as it provides the formation of vigorous and quality seedlings. Therefore, the SMS can be recommended for the growth and nutrition of seedling production.

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