

## RESEARCH ARTICLE

# Growth promotion of paddy influenced by biological seed treatment using fungal antagonist, *Trichoderma*

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## ABSTRACT

*Trichoderma* species have long been recognized as agents for the control of plant disease and for their ability to increase plant growth and development. Morphologically characterized thirty rhizospheric isolates of *Trichoderma* (*T. harzianum* and *T. virens*) from different locations of Uttarakhand were evaluated under glass house condition for their plant growth promoting potential on paddy crop. Maximum root and shoot growth promotion was achieved with isolate PB 15 (80.3%) and PB 8 (38.5%), respectively in paddy. Maximum length of flag leaf was recorded with isolates PB 23 (43.5 cm) and PB 16 (41.6 cm) while maximum width exhibited by isolates PB 23 (2.1 cm) and PB 8 (1.9cm). Maximum fresh and dry weight was recorded with isolates PB 18 (10.2g) and PB 23 (2.0393g), respectively.

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## INTRODUCTION

*Trichoderma* species have long been recognized as agents for the control of plant diseases and for their ability to increase plant growth and development. The root colonization by *Trichoderma* increases the growth of roots and of the entire plant, thereby increasing plant productivity. The root colonization by *Trichoderma* increases the growth of roots and of the entire plant, thereby increasing plant productivity. As a result of rather intensive work carried out with *Trichoderma*, several independent research groups have noticed that the addition of antagonist, *Trichoderma* spp. induced the seed germination/emergence and growth of various crops (Chet, 1987; Kleifeld and Chet, 1992; Ousley *et al.*, 1993). In both academic research and commercial practice, strain T-<sub>22</sub> has been well established for its affectivity to increase root development in maize and numerous other crop plants (Harman, 2000; Harman *et al.*, 2004). Plant growth promotion activity of *Trichoderma* spp. has also been well documented by Harman *et al.* (2004), Hyakumachi (2004), Punja and Utkhede (2003), Whipps and Lumsden (2001) and Wu *et*

*al.* (2005). Use of the chemical fertilizers in intensive agriculture resulted in damage to soil and water resources and being depleted soil fertility and hence, keeping the above facts in view the present investigation was undertaken using thirty isolates of *Trichoderma* (*T. harzianum* and *T. virens*) from different rhizospheric soil of Uttarakhand which were evaluated to know their activity of enhance plant growth on paddy.

## MATERIALS AND METHODS

Experimental materials, *Trichoderma* strains were isolated from rhizospheric soils of different crops and locations of Uttarakhand (Table A) and seeds of paddy (cv. Pant Dhan-4) were obtained from SPC, Pantnagar. The pot experiment was conducted under glass house conditions to study the growth promoting potential of *Trichoderma* on paddy. Paddy seeds (surface sterilized) were treated with powdered formations of biocontrol agents (@ 10g/kg seeds; cfu=10<sup>9</sup>/g powder) and ten seeds per pot were sown with triplicates for each treatment including control in plastic pots (5 kg capacity)

**Table A : Soil samples collected from different locations**

Sr. No.	Crop	Location	Isolate code
1.	Paddy	Kathgodam-Haldwani	PB1
2.	Paddy	Halduchaur-Haldwani	PB2
3.	Paddy	Lamachaur-Haldwani	PB3
4.	Paddy	Kherna-Almora	PB4
5.	Paddy	Kherna-Almora	PB5
6.	Paddy	Kherna-Almora	PB6
7.	Paddy	Kherna-Almora	PB7
8.	Paddy	SPC-Pantnagar	PB8
9.	Paddy	SPC-Pantnagar	PB9
10.	Paddy	Rudrapur-U.S. Nagar	PB10
11.	Paddy	Rudrapur-U.S. Nagar	PB11
12.	Paddy	Rudrapur-U.S. Nagar	PB12
13.	Paddy	Rudrapur-U.S. Nagar	PB13
14.	Paddy	Rudrapur-U.S. Nagar	PB14
15.	Apple	Mukteshwar-Almora	PB15
16.	Broccoli	Mukteshwar-Almora	PB16
17.	Pea	Mukteshwar-Almora	PB17
18.	Pea	Mukteshwar-Almora	PB18
19.	Strawberry	Mukteshwar-Almora	PB19
20.	Walnut	Mukteshwar-Almora	PB20
21.	Paddy	Premnagar-Dehradun	PB21
22.	Mustard	Premnagar-Dehradun	PB22
23.	Maize	Dhalwala-Rishikesh	PB23
24.	Maize	Bhaniawala-Dehradun	PB24
25.	Paddy	Bhaniawala-Dehradun	PB25
26.	Paddy	Mazra-Ranipokhri	PB26
27.	Maize	Geetanagar Rishikesh	PB27
28.	Paddy	Raipur-Dehradun	PB28
29.	Paddy	Raiwala-Haridwar	PB29
30.	Paddy	Nagani, Tehri Garhwal	PB30

containing sterilized soil. Five days after germination pots were thinned to three plants per pot and watered regularly to keep the proper soil moisture. Three plants were uprooted after three weeks of transplanting from each pot. Observations were recorded for root and shoot length, fresh and dry weight, flag leaf length and width and compared with control.

## RESULTS AND DISCUSSION

The dry formulations of *Trichoderma* were applied through seed treatment to evaluate growth promotion activity of different isolates of *Trichoderma* on paddy. All the isolates significantly suppressed sheath blight development 30 days after application as seed treatment. Results on growth

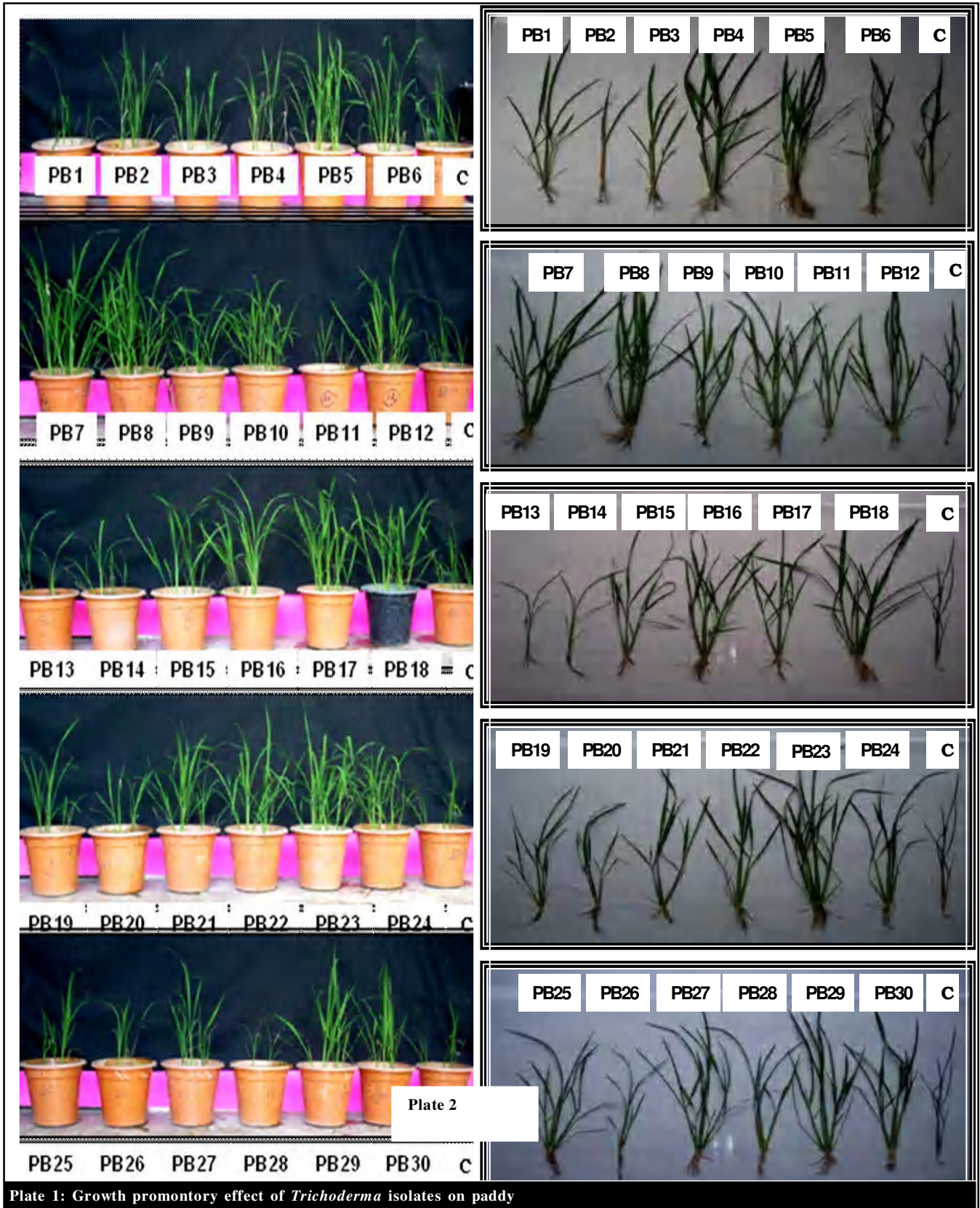
promotion (Table 1 and Plate 1) revealed that all the isolates except PB 1 (6.1cm) resulted in higher root length as compared to check (6.2cm). Maximum root length was recorded with isolate PB 15 (31.5cm) followed by PB 18 (17.2cm), PB 7 (16.2cm), PB 8 (14.2cm) and PB 16 (14.1cm) whereas minimum root length was obtained with isolate PB 13 (6.5cm). All the thirty isolates exhibited higher shoot length as compared to check. Isolate PB 8 resulted in maximum shoot length (57.1 cm) followed by PB 7 (56.4cm), PB 23 (56.1cm) and PB 10 (54.1cm) whereas minimum shoot length was recorded with isolate PB 3 and PB 14 (37.3cm) followed by PB 25 (37.6cm). Maximum fresh and dry weight was recorded with isolates PB 18 (10.2g) and PB 23 (2.0393g), respectively. Maximum flag leaf length was recorded with isolate PB 23 (43.5 cm) followed by PB 16 (41.6 cm) and

PB 8 (41.2 cm) and isolate PB 5, 12, 17 and 22 were at par. Maximum flag leaf width was recorded with isolate PB 23 (2.1 cm) followed by PB 8 (1.9 cm) and isolate PB 20, 26, 28 and control were at par. The flag leaf is indicative of growth and yield potential of the paddy. Isolate PB 8 exhibited good length and width of flag was also recorded as potential shoot and root growth promoting isolate for paddy in the present investigation. Interesting observation was recorded against isolate PB 21 with negative effect on flag leaf length (22.1 cm) and width (1.3 cm) as compared to control (23.3 cm and 1.4 cm). Three isolates (PB 7, 15 and 18) incremented 60-80 per

cent root length and up to 60 per cent by remaining isolates. Out of thirty, 25 isolates incremented 10-40 per cent shoot length and less than 10 per cent by rest of the isolates, 11 isolates exhibited 30-40 per cent shoot length increment in rice. More than 80 per cent increment in fresh and dry weight was achieved by isolates PB 10 and PB 8, respectively. The above results are in accordance with Yossen *et al.* (2003) who reported increased weight and height of lettuce seedlings and Yehia *et al.* (1985) reported increased fresh and dry weight of shoots, roots and nodules of broad bean when seeds were treated with *Trichoderma*. The results are also supported with

**Table 1 : Growth promotory effect of *Trichoderma* isolates on paddy**

Isolate no.	Root length (cm)	Shoot length (cm)	Fresh weight (g)	Dry weight (g)	Flag leaf measurement (cm)	
	21 DAT	21 DAT	21 DAT	21 DAT	Length	Width
PB1	6.1	40.0	1.97	0.4534	31.5	1.7
PB2	7.5	39.4	1.21	0.2261	29.3	1.6
PB3	7.4	37.3	1.51	0.3167	40.4	1.7
PB4	13.7	52.4	3.42	1.6576	26.5	1.7
PB5	12.7	46.1	6.31	1.0259	22.7	1.5
PB6	9.2	42.1	2.77	0.9676	33.8	1.5
PB7	16.2	56.4	9.36	1.5222	34.3	1.7
PB8	14.2	57.1	3.91	1.6375	41.2	1.9
PB9	8.2	38.2	3.55	0.6975	35.0	1.6
PB10	14.1	54.1	5.94	1.3182	25.3	1.5
PB11	7.2	39.3	1.81	0.3981	26.3	1.5
PB12	10.1	39.1	5.41	1.0346	22.3	1.5
PB13	6.5	48.8	0.98	0.1188	32.8	1.6
PB14	8.8	37.3	1.33	0.1941	30.3	1.6
PB15	31.5	51.1	3.44	0.6361	30.6	1.7
PB16	14.1	51.3	6.56	1.2391	41.6	1.8
PB17	13.3	50.8	3.52	0.6113	23.4	1.7
PB18	17.2	51.3	10.23	1.8846	32.3	1.7
PB19	10.0	38.2	2.01	0.3819	31.5	1.5
PB20	7.1	40.2	1.94	0.3143	25.2	1.4
PB21	6.7	42.2	3.22	0.5536	22.1	1.3
PB22	7.4	44.9	3.75	0.7269	23.5	1.5
PB23	10.6	56.1	9.76	2.0393	43.5	2.1
PB24	7.8	48.4	3.25	0.5404	35.5	1.8
PB25	11.3	37.6	4.03	0.6582	27.3	1.8
PB26	9.4	39.0	1.20	0.2286	25.5	1.4
PB27	14.0	46.2	5.66	1.0595	28.1	1.5
PB28	7.1	45.5	2.95	0.4175	25.5	1.4
PB29	12.1	53.7	6.91	0.9489	31.2	1.7
PB30	11.9	53.2	5.41	1.3351	30.2	1.6
Control	6.2	35.1	1.03	0.2195	23.3	1.4
C.D.(p=0.05)	12.05	0.20	0.05	0.0012	0.4	0.1



the findings of Chet *et al.* (1997), Barea *et al.* (2002) and Mariola *et al.* (2007) where they reported that seeds germinated more synchronously, plant sizes were more homogeneous and the root system grew more profusely and considerable yield increase in fields and green house conditions when plant seeds were previously treated with spores from *Trichoderma*. Plant growth promotion activity of *Trichoderma* spp. has also been well documented by Whipps and Lumsden (2001), Punja and Utkhede (2003), Harman and Bjorkmann (1998), Harman *et al.* (2004) and Wu *et al.* (2005).

### Conclusion :

Glass house studies concluded that *Trichoderma* isolates PB 7, 15 and 18 were highly efficient root growth promoting and PB 8, 7, 10 shoot growth promoting isolates in paddy. Maximum fresh and dry weight was recorded with isolates PB 18 and PB 23, respectively. Isolate PB 7 was efficient root and shoot growth promoter both but it is not essential that good root growth promoter would be good shoot growth promoter or *vice-versa*. The isolate PB 23 was found effective for incrementing dry weight and length and width of flag leaf.

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