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Planting methods, subsurface drip fertigation and bioinoculants on growth and productivity of vetiver [*Vetiveria zizanioides* (L.) Nash]

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Abstract

A field experiment was conducted to study the effect of three planting methods, (planting in coconut husk mulched trenches, planting in coconut husk lined trenches and planting on the ridges), two levels of fertigation (subsurface drip fertigation and without fertigation) and two levels of bioinoculants (combined application of bioinoculants and without bioinoculant) on growth and productivity of vetiver. The study revealed that planting vetiver slips in coconut husk lined trenches could considerably increase vegetative growth, root yield, net returns and B: C ratio. Subsurface drip fertigation and combined application of bioinoculants with *Azospirillum, Fluorescent pseudomonads* and AM fungi showed positive effect on growth characters and root yield. However, subsurface drip fertigation was not effective in increasing net income.

Keywords: bioinoculants, planting methods, subsurface drip fertigation, vetiver

Vetiver (*Vetiveria zizanioides*) is a perennial scented non-invasive C4 grass with abundant network of roots. These roots make vetiver a miracle grass for its multifarious applications in soil and water conservation programmes. Since vetiver root is a rich source of essential oil containing complex mixture of sesquiterpene alcohols and hydrocarbons, it is being extensively used in perfumery and cosmetics. These fast growing grasses with deep root systems can also facilitate carbon sequestration which is significant in the context of global warming (Lavania & Lavania 2009). Besides, vetiver roots are widely used for medicinal purposes, ranging from common cold to cancer treatment. It is also used as a raw material for making handicrafts, substrates for composting, construction material, ethanol production etc.

Though vetiver is a hardy plant by nature, during its early stage of growth it is rather weak as propagated by slips. So for better establishment and performance of the crop, suitable planting methods integrated with appropriate moisture conservation measures and bioinoculants assume greater significance. *Azospirillum, Fluorescent pseudomonads* and AM fungi are potential agents along with appropriate blend of biomanures *viz.*, vermicompost, coir pith compost and poultry manure for accelerated vegetative growth and root development in vetiver. Subsurface drip fertigation with perforated drip lines offers delivery of liquid manures and irrigation water directly into the root zone and also helps to maintain a favourable moisture- nutrient – oxygen balance in the rhizosphere for better growth of the crop. With this background, the present trial was undertaken to study the effect of planting methods, subsurface drip fertigation and combined application of bioinoculants on growth and productivity in vetiver.

The experiment was undertaken at the Instructional Farm of College of Agriculture, Vellayani during 2010–2011. The farm is located at 8° 5′ N latitude and 76° 9′ E longitude at an altitude of 29 m above MSL. The soil of the experimental site is red sandy clay loam (Oxisol, Vellayani series). Vetiver slips (local variety) were collected from the herbal garden of Instructional Farm, Vellayani and planted on 5th April in the plots of size 2 m × 2 m maintaining 16 plants $plot^{-1}$. The experiment was laid out in Factorial RBD replicated thrice. The treatments consisted of combinations of three planting methods, two levels of fertigation and two levels of bioinoculants. The planting methods included planting in coconut husk mulched trenches (P_1), planting in coconut husk lined trenches (P_2) and planting on the ridges (P_3). Two levels of fertigation included subsurface drip fertigation (F_1) and without drip fertigation (F_2). Combined application of bioinoculants (B_1) was done with *Azospirillum*, *Pseudomonas* and AMF against no bioinoculant (B_2). For planting vetiver in coconut husk mulched trenches, vetiver slips were taken and planted in trenches of 0.5 m wide and 1.0 m deep in paired row at a spacing of 25 / 100 cm × 50 cm. The trenches were mulched with a layer of coconut husk at the bottom (concave side upwards) and filled with enriched rooting medium consisting of a mixture of vermicompost, coir pith compost, poultry manure and soil in 1:1:1:1 proportion. In the second planting method, trenches of 0.5 m wide and 1.0 m deep were taken and the sides of the trenches were lined with coconut husk (concave side facing root zone) in addition to coconut husk mulched at the bottom. Paired row planting of slips was also done at a spacing of 25 / 100 cm × 50 cm and filled with enriched rooting medium consisting of a mixture of vermicompost, coir pith compost, poultry manure and soil in 1:1:1:1 proportion in these trenches. Vetiver slips were also planted on 1.0 m wide ridges in two rows at a spacing of 50 cm × 50 cm. Subsurface drip fertigation was done with vermiwash and cow's urine @ 1 L each diluted in 10 L of water and given through perforated HDPE tube laid out above the coconut husk mulch at the time of planting. Subsurface drip fertigation was started two weeks after planting and continued up to two weeks before harvest avoiding application in the rainy days. Bioinoculants like *Azospirillum*, AM fungi, *Fluorescent pseudomonads* were given to vetiver slips. *Azospirillum* was mixed with cow dung slurry and the slips (root) dipped in the slurry for 30 minutes before planting. AM fungi was applied at the time of planting @ 10 g planting $hole^{-1}$ in such a way that the root surface was in contact with the inoculum. *Fluorescent pseudomonads* @ 10 g mixed with 2 kg vermicompost were broadcasted one week after planting. Growth characters like plant height, number of functional leaves and number of tillers were noted from each plot from the observation plants one year after planting. Plant height was measured from the base of the plant to the tip of the tallest leaf and expressed in cm. Number of functional leaves and numbers of tillers produced in a plant were counted from the observation plants and mean values of them were recorded. For recording root yield, the plants were uprooted from each plot one year after planting. The total root dry weight was calculated from each plot separately and expressed in t ha^{-1}. Net returns and B: C ratio were calculated as per standard procedures. The observations were subjected to statistical analysis and the critical difference (C.D) between the treatment means at 5% level of significance were determined following the statistical table of Fisher & Yates (1979).

Data on the effect of planting methods, fertigation levels and bioinoculants on plant height, number of tillers, leaf number and root yield are presented in Table 1. Among the different planting methods, planting vetiver slips in coconut husk lined trenches registered

Table 1. Effect of planting methods, fertigation levels and bioinoculants on biometric characters and root yield at 12 months after planting and economics

Treatments	Plant height (cm)	Number of tillers	Number of leaves	Root yield (t ha^{-1})	Net returns (Rs ha^{-1})	B:C ratio
Planting methods						
Planting in coconut husk mulched trenches	187.50	48.91	129.41	3.66	1,15,029	2.70
Planting in coconut husk lined trenches	191.75	51.08	152.50	3.93	1,28,322	2.89
Planting on the ridges	182.58	44.41	109.83	3.30	97,341	2.44
CD(P<0.05)	4.40	4.62	18.33	0.43	21,513	0.31
Fertigation						
Subsurface drip fertigation	191.42	50.94	145.22	3.83	1,15,983	2.53
No fertigation	183.27	45.33	115.94	3.43	1,11,145	2.83
CD(P<0.05)	3.59	3.75	14.96	0.35	-	0.25
Bioinoculants						
Combined application of bioinoculants	189.89	51.00	137.72	3.84	1,23,853	2.82
No bioinoculant	184.83	45.27	123.44	3.41	1,03,275	2.54
CD(P<0.05)	3.59	3.77	-	0.35	17,565	0.25

a higher plant height (191.75 cm), number of leaves (152.50) and number of tillers (51.08). Root yield was found to be significantly improved by planting in coconut husk lined trenches to the tune of 19.09% compared to planting on ridges. Application of subsurface drip fertigation also exerted significant influence on plant height, number of leaves and tillers compared to no fertigation. A 25% increase in number of leaves was observed against no fertigation. Root yield also could be significantly increased to the extent of 11.66% by subsurface drip fertigation. Subsurface drip irrigation enables the nutrients to reach directly to the root-zone and promote sturdy and deep root growth. Subsurface drip fertigation caused significant improvement in growth characters of vetiver. Similar effect was observed by Martinez *et al.* (1991) for plant height in corn. Combined application of bioinoculants also showed significant improvement of plant height, number of tillers and root yield. Plant growth promoting rhizobacteria when grown in association with a host plant, results in the stimulation of that plant through one or more mechanisms, such as improving mineral nutrition assimilation, disease suppression and phyto-hormone production resulting in encouraged root and vegetative growth (Lucy *et al.* 2004).

Net income and B: C ratio were also significantly influenced by planting in coconut husk lined trenches with highest values of Rs. 1,28,322 and 2.89, respectively (Table 1). Subsurface drip fertigation did not influence net income. An increase of 11.02% in B: C ratio was obtained due to the application of bioinoculants compared to no bioinoculant.

It is concluded that growth characters like plant height, number of leaves, tillers, root yield, net returns and B:C ratio could be increased by planting vetiver slips in coconut husk lined trenches. Though subsurface drip fertigation showed positive effect on growth characters and root yield, it could not exert any significant benefit on net income. Combined application of bioinoculants like *Azospirillum, Fluorescent pseudomonads* and AM fungi was also found to be very effective.

References

Fisher R A & Yates F 1979 Statistical tables for biological agriculture and medicinal research (6th edition), Longman group, London.

Lavania U C & Lavania S 2009 Sequestration of atmospheric carbon into subsoil horizons through deep-rooted grasses – vetiver grass model. Curr. Sci. 97: 618–619.

Lucy M, Reed E & Glick B R 2004 Applications of free living plant growth promoting rhizobacteria. A Van Leeuw J. Microb. 86: 1–25.

Martinez J J H, Yosef B B & Kafkafi U 1991 Effect of surface and subsurface drip fertigation on sweet corn rooting, uptake, dry matter production and yield. Irri. Sci. 12: 153–159.