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Effect of Safed Musli + Pigeonpea Intercropping System on Root Quality of Safed Musli

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A B S T R A C T

The field experiment was conducted at Nagarjun Medicinal Plant Garden, Dr. Panjabrao Deshmukh Krishi Vidyapith, Akola during the *kharif* season 2015-2016 and 2016-2017. The experiment was under Safed musli+ Pigeonpea intercropping with various row proportions T_1 – Safed musli + Pigeonpea 2:1 row proportion, T_2 – Safed musli+ Pigeonpea 3:1 row proportion, T_3 – Safed musli + Pigeonpea 2:2 row proportion, T_4 – Safed musli + Pigeonpea 1:2 row proportion, T_5 – Sole Safed musli, T_6 – Sole Pigeonpea. The experiment was laid in Randomized Block Design with four replications and six treatments. Saponin content and yield was significantly influenced in treatment T_2 under Safed musli+ Pigeonpea 3:1 row proportion. Protein content was significantly influenced under Safed musli + Pigeonpea 2:2 row proportion.

Introduction

Diversification of crops with intercropping can give higher yield than sole crops (Mandal *et al.*, 1986). Thus selecting compatible combination of crops is necessary for maximum utilization of growth resources, viz., solar energy and water unit area unit^{-1} time that will also keep the soil in better physical condition with improvement in yield. Hence, choice of component crops in intercropping needs to be suitably maneuvered to harvest the synergism among them towards efficient utilization of resource base and to increase overall productivity (Anderson, 2005). The main concept of intercropping is to get increased total productivity per unit area and time, besides equitable and judicious utilization of land resources and farming inputs including labour. One of the main reasons for higher yield in intercropping is that the component crops are able to use natural resources differently and make better overall use of natural resources than grown separately (Willey, 1979). A careful selection of crops having different growth habit can reduce the mutual competition to a considerable extent. *Chlorophytum*

borivilianum is a perennial important herb known as 'Safed musli' which is a root crop belonging to the family *Liliaceae*. The species was first described from India in 1954 and reached rare status in nature due to over exploitation. It is widely distributed in India, particularly in the valley of Himalaya, Satpuda, Vindhya, Aravalli and in the parts of Rajasthan, Gujarat and Maharashtra. The roots of *Chlorophytum borivilianum* have great medicinal value due to saponin content and used extensively in Ayurvedic medicines. The economic part of the herb is root and is well known tonic and aphrodisiac drug given to cure general debility. Tribals in central India use leaves of this herb for vegetable purpose. The genus *chlorophytum* consist of more than 300 species in the world and only 13 are available in India out of which six are more important. The species of *Chlorophytum borivilanum* contains more saponin and good yielding potentials as compared to other species of Safed musli and therefore having commercial value. Safed musli have annual demand around 35000 MT while only 15000 MT is the production. Now a day, there is a very vast demand all over the world (especially gulf countries and cold countries). Due to its vast demand it is very costly and become a hot cake among medicinal plants. Pigeonpea is an important legume food and, drought tolerant crop and having potential to sustain productivity and profitability in drought prone areas. Being a legume, the residual nitrogen available to subsequent crop is estimated to around 40 kg ha^{-1}. Intercropping with Pigeonpea provides an opportunity to grow them together as they have different growth habits and maturity period. The Pigeonpea being deep rooted and comparatively slow growing in its early growth stage, during which the more rapidly growing crops like Safed musli can be conveniently intercropped to utilize natural resources more efficiently. The sole cropping of safed musli has a risk. The replacement of traditional crops with alternative crops like Safed musli may be unsustainable in large context and therefore it is necessary to explore the possibilities of the growing these crops as an intercrop with the traditional crop in efficient cropping systems. In order to generate useful information for such type of potential areas, present investigations to study the soil fertility, productivity and economics of Safed musli and Pigeonpea intercropping under rainfed condition has proposed.

Materials and Methods

The field experiment was conducted during *kharif* season 2015-2016 and 2016-2017 at Nagarjun medicinal plant Garden Dr. PDKV Akola. Experiment was laid in Randomized Block Design with four replications and six treatments. The experimental soil order was Inceptisol, the fertility status of soil was moderate in organic carbon, low in available nitrogen and available phosphorus and very high in available potassium while the soil micronutrient contents (Zn, Fe, Mn, Cu) were above the critical level. The experiment consist of six treatments T_1 – Safed musli + Pigeonpea 2:1 row proportion, T_2- Safed musli+ Pigeonpea 3:1 row proportion, T_3 – Safed musli + Pigeonpea 2:2 row proportion, T_4 – Safed musli + Pigeonpea 1:2 row proportion, T_5 – Sole Safed musli, T_6 –Sole Pigeonpea. FYM @ 20 t ha^{-1} will be common for all treatments) of Safed musli and for Pigeonpea: FYM @ equivalent to RDF (25 kg N ha^{-1})

Results and Discussion

Saponin content

On persual of data presented in Table 1 the saponin content of Safed musli under different row proportions varied from 5.98 to 6.92 % and 5.99 to 6.94 during both years respectively.

Further it was observed that saponin content was significantly influenced with treatment of Safed musli + Pigeonpea in 3:1 row proportion (T_2) which was at par with rest of the treatments except T3 i.e., Safed musli + Pigeonpea in 2:2 row proportion.

The results on saponin content during second year (2016-17) also showed similar trend. However, the pooled data indicated that significantly highest saponin content was observed under Safed musli + Pigeonpea in 3:1 row proportion (T_2) which was at par with treatment T_5 (Sole Safed musli) and T_4 (Safed musli + Pigeonpea in 1:2 row proportion).

Saponin yield

The data (Table 1) regarding saponin yield as influenced by different row proportions varied from 15.00 to 39.23 and 14.00 and 35.87 kg ha^{-1} in 2015-16 and 2016-17 respectively. Further, it was observed that significantly highest saponin yield (39.23 kg ha^{-1}) was observed in treatment T_2 i.e. of Safed musli + Pigeonpea in 3:1 row proportion followed by T_5 (Sole Safed musli). Lowest saponin yield (15.00 kg ha^{-1}) was observed in T_4 with Safed musli + Pigeonpea in 1:2 row proportion. Whereas, results during second year (2016-17) revealed that significant highest saponin yield (35.87 kg ha^{-1}) was observed with treatment T_2 with Safed musli + Pigeonpea in 1:2 row proportion which was at par with treatment T_5 i.e. sole safed musli. However pooled mean showed that the Safed musli + Pigeonpea in 3:1 row proportion (T_2) was found superior overall treatments to recorded highest saponin yield (37.55 kg ha^{-1}) followed by Sole Safed musli (T_5).

The lowest saponin yield was noticed under treatment T_4 with Safed musli + Pigeonpea in 1:2 row proportion. Intercropping of Safed musli with Pigeonpea resulted in better root quality in terms of saponin which is the active ingredient might due to proper utilization of solar light with balanced nutrition resulted in better synthesis of secondary metabolites and ultimately the root quality with good yield. Wankhade *et al.*, (2004) also noticed higher saponin yield with the FYM application and significantly highest value were noticed with 20 t FYM ha^{-1}

Table.1 Safed musli root quality as influenced by safed musli + pigeonpea intercropping system

Treatments	Saponin content (%)			Saponin yield (kg ha^{-1})		
	2015-16	2016-17	Pooled	2015-16	2016-17	Pooled
T_1 - Safed musli + Pigeonpea (2:1)	6.38	6.53	6.45	26.47	25.07	25.77
T_2 - Safed musli + Pigeonpea (3:1)	6.92	6.94	6.93	39.23	35.87	37.55
T_3 - Safed musli + Pigeonpea (2:2)	5.98	5.99	5.99	22.90	21.98	22.44
T_4 - Safed musli + Pigeonpea (1:2)	6.64	6.67	6.65	15.00	14.00	14.50
T_5 - Sole Safed musli	6.71	6.76	6.74	36.63	34.67	35.65
T_6 - Sole Pigeonpea	-	-	-	-	-	-
SE (m) ±	0.20	0.19	0.096	0.90	0.91	0.56
CD at 5%	0.61	0.59	0.29	2.70	2.74	1.70

Table.2 Safed musli root quality as influenced by safed musli + pigeonpea intercropping system

Treatments	Protein content (%)		
	2015-16	2016-17	Pooled
T_1 - Safed musli + Pigeonpea (2:1)	10.41	9.97	10.19
T_2 - Safed musli + Pigeonpea (3:1)	10.77	10.00	10.39
T_3 - Safed musli + Pigeonpea (2:2)	11.22	11.09	11.16
T_4 - Safed musli + Pigeonpea (1:2)	10.94	10.83	10.88
T_5 - Sole Safed musli	10.84	10.39	10.61
T_6 - Sole Pigeonpea	-	-	-
SE (m) ±	0.40	0.37	0.18
CD at 5%	NS	0.75	0.56

Protein content

The data on protein content of safed musli are presented in Table 2 and it was in ranged of 10.41 to 11.22 % and 9.97 to 11.09 % during 2015-16 and 2016-17 respectively. The protein content was not significantly influenced in first year study, however, numerically highest content was noted in treatment T_3 (2:2 row proportion).

The second year results revealed that significantly highest protein content of safed musli (11.09 %) was recorded under treatment T_3 with safed musli + pigeonpea in 2:2 row proportion which was at par with treatment T_4 (1:2 row proportion) and treatment T_5 (sole safed musli). Lowest protein content was observed in treatment T_1 with the safed musli + pigeonpea in 2:1 row proportion (9.97%). Pooled result indicated that significantly highest (11.16 %) protein content was recorded with treatment T_3 (2:2 row proportion) which was at par with T_4 safed musli + pigeonpea in 1:2 row proportion and T_5 (sole safed musli). Results are in agreement with the findings of Wankhade *et al.*, (2004).

The root quality (saponin content and saponin yield) of Safed musli was significantly influenced in treatment T_2 with Safed musli + Pigeonpea in 3:1 row proportion. Protein content was significantly influenced under treatment T_3 i.e. Safed musli + Pigeonpea in 2:2 row proportion.

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