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Influence of integrated nutrient management on growth, yield and quality of makoi

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ABSTRACT

Integrated nutreint management (INM) is the judicious use of one or more sources of plant nutrients either individual or in combination. It mainly aims at achieving maximum fertilizer use efficiency, besides reducing toxic residues in both soil and plant. In this view a field experiment was conducted during the year 2002 - 2003 at Department of Horticulture, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore to know the influence of different manures and fertilizers on grrowth, yield and quality of makoi (*Solanum nigrum* L.), a very important, upcoming medicinal plant. The treatments consisted of organic manures (FYM, city compost and poultry manure) and inorganic fertilizers alone and in different combinations. The results revealed that the plants suppled with 75 per cent nutrients through fertilizers + 25 per cent through poultry manure recorded maximum plant height, number of branches, number of leaves, leaf area, fresh and dry yield of the whole herb. Whereas, the highest alkaloid content was recorded in the plants supplied only with poultry manure and the maximum alkaloid yield was in plants supplied with 75 per cent nutreints through fertilizers + 25 per cent through city compost.

Key words: Makoi, INM, FYM, city compost, poultry manure.

INTRODUCTION

Over eight hundred plant species are used by the industries for medicinal preparation, but paradoxically ninety percent of them are collected from wild sources and only the minority is substantially produced and harvestd through cultivation. Further, more than seventy percent of such plant collection involves destructive harvesting. Hence, preservation of this medicinal plant diversity through cultivation is therefore, of prime importance and needs to be addressed adequately on high priority basis. *Makoi* (*Solanum nigrum* L.) belonging to the family Solanaceae, is a very important upcoming medicinal plant. The plant is commonly known as 'Black night shade' in English, '*Makoi'* or '*Makoy'* in Hindi. The whole herb has economic value and contains glyco-alkaloids namely, solanigrin, solamargine and solasonine. The whole herb has anticeptic, antidysentric, emmolient, diuretic, laxative properties and also used in the treatment of scrofulous dyscreasis, in virulent gonorhoea, wounds, sores, malaria and against heart diseases (Dhar *et al*., 5). Therfore, it has a great demand from pharmaceutical industries and become popular with a wide range of herbal products including Actilivforte, Geriforte, Herbolax, Manol, Liv-52, Eve Care etc. In recent years there is a great demand for organically grown herbal products in national and international markets, as the organically grown herbal products should have less residual toxicity as they are directly involved in medicine preparation. Hence, use of organic manures in combination with inorganic fertilizers plays a very important role in sustaining growth, yield and quality of medicinal crops. There are no reports on its cultivation by integrated nutrient management (INM), and at the same time there is a growing demand for this crop which necessiates its cultivation on a commercial scale. In view of the global trend away from synthetics and towards herbal products in health care and consequent steep in demand, there is a need for systematic cultivation of this plant. Hence, the pesent study was undertaken to kow the influence of integragted nutrient management on growth, yield and quality of *makoi* .

MATERIALS AND METHODS

The field experiment was conducted at the Department of Horticulture, University of Agricultural Sciences, Gandhi Krishi Vignana Kendra, Bangalore during 2002-2003, to find out the influence of integrated

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Table 1. The nutreint composition of different organic manures.

	N (%)	P_2O_5 (%)	K_2O (%)
Farm yard manure	1.0	2.0	1.1
City compost	0.90	0.85	0.95
Poultry manure	3.02	2.63	1.40

nutreint management practices in *makoi*. The soil of the experimental field was red sandy clay loam intermixture, had pH 6.4, EC 0.22 m mhos cm^{-2} and 1.36 percent organic carbon. Soil had 604.80, 32.00 and 395.00 kg ha^{-1} available nitrogen, phosphorous and potash, respectively. The weather conditions prevailing at the experimental site during the period of experiment was as follows: mean average rainfall 57.04 mm, mean maximum temperature 28°C, mean minimum temperature 17.75°C, relative humidity 56.33 percent, mean sunshine hours 4.98 h day^{-1}, mean wind velocity 8.73 km h^{-1} and mean open pan evaporation 4.77 mm day^{-1}. The experiment was laid out in a Randomized Complete Block Design (RCBD) replicated thrice. The experimental site was red sandy clay loam intermixture and of uniform fertility status, grouped under the classification of Alfisols. The crop had received recommended dose of fertilizers (RDF) 100:50:50 kg ha^{-1} through different organic manures *viz.,* FYM, city compost and poultry manure and fertilizers *viz.,* urea, single super phosphate and muriate of potash in single or in combination of different levels of organic and inorganic fertilizers. The percent nutrient compostion of different manures is presented in Table 1. Diferent organic manures were applied to the main field fifteen days before transplanting and were allowed for decomposition. The crop was supplied with half dose of nitrogen and full dose of phosphorus and potash as a basal dose at the time of planting in control. The remaining 50 percent was given thirty days after transplanting as top dressing. Seeds were pre-soaked in 500 ppm GA_3 for 12 hours to overcome internal dormancy and sown in raised nursery beds. Thirty days old healthy, uniform size seedlings were used for transplanting in the experimental plots at row to row spacing of 60 cm with a plant to plant spacing of 4 cm. The plots were kept weed free by periodic hand weeding. The first irrigation was given immideately after transplanting, once in three days for two weeks and thereafter, irrigated at weekly interval. Earthing up was done 30 days after transplanting to provide better anchorage to the plants after top dressing.

During the grwoth period, severe infestation of both bacterial and fungal wilt was obderved. The bacterial wilt was controlled by drenching streptocycline (1 g 20 l^{-1} of water) and fungal wilt by drenching 0.1 percent bavistin. Three sprays of nuvacron 0.1 percent spray was given to control inset pests such as borers and aphids. The crop was harvested three months after planting at matrure green berry stage (Pushpalatha, 12), to obtain maximum alkaloid yield. The whole plants were harvested by cutting the plants at 15 cm above graond level. The freshly harvested plants were cut into pieces of convenient length along with green immature berries intact. Dry biomass yield of the herb was taken by drying the fresh herb in hot air oven at 70°C till a moisture level of 8 percent was obtained. The total alkaloid content in the dry herb was estimated by following the procedure ooutlined by Guseva *et al*. (8) and Harborne (9). Alkaloid yield was calculated based on the herbage yield and alkaloid content. The data was analyzed statistically using standard statistical procedure (Gomez and Gomez, 3).

RESULTS AND DISCUSSION

The results revealed that the application of different levels of manures, fertilizers and their combinations significantly influenced the platn height, number of branches, number of leaves, leaf area, fresh and dry weight per hectare, alkaloid content and alkaloid yield (Table 2; Fig. 1). Majority of the growth parameters such as the highest plant height (129.27 cm), maximum number of branches per plant (22.13), maximum number of leaves per plant (969.87), maximum leaf area (10,668.55 cm^2) at harvest was recorded by the plants supplied with 75 percent RDF through fertilizers + 25 percent RDF through Poultry manure (T_{11}) and all these factors were minimum in the plots receiving only organic manures 33.33 percent RDF through FYM + 33.33 percent RDF through city compost + 33.33 percent RDF through poultry manure (T_{14}). The improved growth of plants suplied with poultry manure along with fertilizers might be attributed to the increased N uptake and utilization. Poultry manure contains certain growth promoting substances which induced better plant growth (Brown, 2). Another factor contributing to the better plant growth with poultry manure might be the presence of high nitrogen (3.02%) and phosphorous content (2.63 %) and increased availability of native soil phosphorous and biological activity as reported by Singh and Srivatsava (13). Enhanced plant growth with the application of poultry manure and inorganic fertilizers have been reported by Abusaleha (1) in bhendi, Dhandapani (4) in cauliflower, Yousef *et al*. (14) and Chindo and Khan (3) in tomato and Hassain (10) in pepper.

The fresh and dry herb yield (Fig. 1) also showed a positive response to the application of different forms of organic manures and fertilizers. Again, the combination

Table 2. Effect of integrated nutrient management on growth attributes of makoi (*Solanum nigrum* L.).

Treatments	Plant height (cm)	No. of branches	Plant spread (cm^2)	No.of leaves per plant	Leaf area (cm^2)
T_1 100% RDF	99.9	11.33	9635.2	394.0	5544.36
T_2 100% RDF through FYM	98.17	12.07	5485.8	412.27	5586.2
T_3 75% RDF +25% RDF through FYM	94.83	15.2	10034.13	774.07	10488.59
T_4 50% RDF +50% RDF through FYM	85.73	11.33	6494.79	342.6	4741.6
T_5 25% RDF +75% RDF through FYM	92	11.67	6064.73	496.4	6785.95
T_6 100% RDF through CC	79.07	9.87	5292.39	299.27	4028.4
T_7 75% RDF +25% RDF through CC	105.77	17.6	8278.73	556.93	7546.45
T_8 50% RDF +50% RDF through CC	89.57	12.13	10113.47	486.4	6590.72
T_9 25% RDF +75% RDF through CC	100.43	12.33	7532.59	448.53	6515.74
T_{10} 100% RDF through PM	88.07	11.33	4907.2	404.00	5677.16
T_{11} 75% RDF +25% RDF through PM	129.27	22.13	8089.93	969.87	10668.55
T_{12} 50% RDF +50% RDF through PM	85.27	11.53	7194.47	371	5747.01
T_{13} 25% RDF +75% RDF through PM	82.7	11.33	6477.00	423.8	5638.61
T_{14} 33.33% RDF through FYM + 33.33% RDF through CC + 33.33% RDF through PM	73.9	9.87	6387.06	336.06	4560.93
CD at 5%	15.27	2.38	NS	126.44	2037.61

RDF – Recommended dose of fertilizers (100:50:50 kg ha^{-1}); FYM – Farm yard manure; CC – City compost; PM – Poultry manure; NS – Non significant

of 75 percent nutrients through fertilizers and 25 percent through poultry manure (T_{11}) recorded increased fresh (46.81 t ha^{-1}) and dry yield (8.83 t ha^{-1}). While, the lowest fresh yield (18.38 t ha^{-1}) was recorded in the plants supplied with 100 percent nutrients through city compost (T_6) and lowest dry yield (1.45 t ha^{-1}) was recorded in the treatment where all the nutrients were supplied through only organic sources (T_{14}). This can be attributed to the slow release of nutrients by the organic sources. The efficacy of inorganic fertilizers is much pronounced when they are combined with organic manure (Fritz and Wonneberger, 6). Organic manures also provide balanced nutrition in addition with enhancing water holding capacity and improving physical, chemical and biological properties of soils. Besides facilitating the growth of micro-organisms, organics assist in better uptake of nutrients. The increased vegetative growth and the balanced C/N ratio might have increased the synthesis of carbohydrates which ultimately promoted greater yield. The increment in fresh weight was probably due to the favourable effect of poultry manure with mineral fertilizer which reserved the sufficient amounts of nitrogen and potassium for the plant development. Poultry manure contain growth promoting substances which induce better plant growth, more number of branches, number of leaves and leaf area which in turn increased the biomass yield of the plant. The increased yield due to the application of poultry manure with inorganic fertilizers corroborated with the findings of Singh and Srivastava (13) in potato; Abusaleha (1) in bhendi, Dhandapani (4) in cauliflower, Jose *et al.* (11) in brinjal and Yousef *et al.* (14) in tomato. The maximum alkaloid yield (29.88 kg ha^{-1}) was in T_7 (75% nutrients through fertilizers + 25% through city compost) which was *on par* with 75 percent nutrients through fertilizers + 25 percent through poultry manure (T_{11}) which recorded 27.37 kg ha^{-1} (Fig. 1). Increase in alkaloid yield with the combination of mineral fertilizers and city compost could be attributed to the high alkaloid content of the herb and increased yield which ultimately resulted in increased alkaloid yield.

Even though, same quantity of nutrients were supplied through either organic or inorganic sources and in combination, application of full dose of nutrients through only organic sources (FYM, city compost and poultry manure) had recorded lower growth and yield compared to inorganic fertilizers applied alone. This might be due to the ready availability and release of nutrients in inorganic fertilizers compared to organic sources.

From the present investigation it could be concluded that the application of 75 percent nutrients through fertilizers + 25 percent through poultry manure recorded the highest fresh biomass yield besides giving maximum alkaloid yield per hectare.

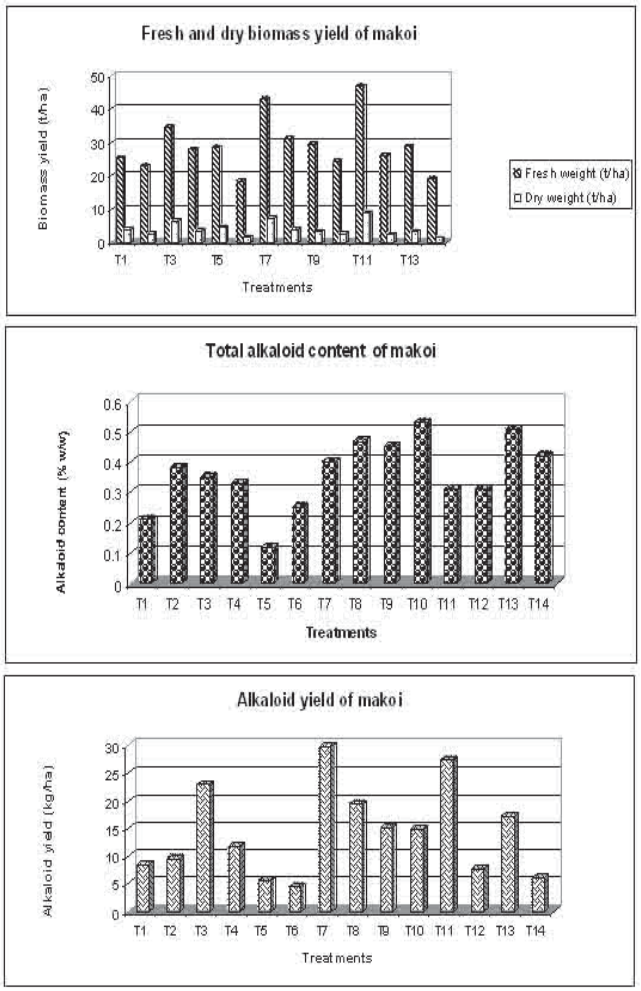

Fig 1. Effect of integrated nutrient management on fresh and dry biomass yield, alkaloid content and alkaloid yield of makoi (*Solanum nigrum* L.).

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