International Journal of Advance Research in Science and Engineering
Vol. No.5, Issue No. 10 , October 2016
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON HERB YIELD AND ESSENTIAL OIL CONTENT OF PEPPERMINT (*Mentha piperita L.*)

Mohd Abdur Rahman[1], Komal Lata Nagpal[2], Zafar Abbas[3],

M.M. Abid Ali Khan[4]

[1,2]*Faculty of Science (Botany) OPJS University Churu, Rajasthan (India)*
[3]*Department of Botany, G.F. College, Shahjahanpur (U.P.) India*
[4]*Department of Botany, Shia P.G. College, Lucknow (U.P.) India*

ABSTRACT

A field experiment was conducted during crop growth period of 2015 (January 2015 to May 2015) on 'Kosi' variety of Peppermint (*Mentha piperita L.*) to study the effect of Integrated Nutrient Management on herb yield essential oil content. Herb and essential oil yield at harvest only in this field experiment under 5 sq.m. bed size, each treatment replicated thrice.

T_1, Control; T_2, FYM @ 20 tonnes/ha; T_3, *Azotobacter spp. +Pseudomonas striata;* T_4, 50% N of RDF+ *Pseudomonas striata;* T_5, 50% P_2O_5 of RDF +*Azotobacter spp.;* T_6, 50% RDF; T_7, 100% RDF; T_8, $T_3 + T_6$; T_9, T_6 + 10 tonnes FYM/ha; T_{10}, $T_3 + T_9$; T_{11}, $T_3 + T_7$; T_{12}, $T_2 + T_3 + T_7$; T_{13}, $T_2 + T_3 + T_6$

It was observed that total herb yield and essential oil content increased significantly by all Integrated Nutrient Management treatments. Treatment T_{13} containing FYM @ 20 tonnes/ha + Azotobacter + Pseudomonas striata+50% RDF was found best for herb yield 56.25% more than control (No treatment).

Key words: *Herb yield, essential oil content, fertilizer (NPK), FYM, Azotobacte and Pseudomonas striata.*

I. INTRODUCTION

Peppermint (*Mentha piperita* L.) is a hardy aromatic herb. This species is a cross between *M. spicata* and *M. aquatica*. This plant has strong odour and a more aromatic taste. It is rich in essential oil (0.5-1.5% approx.). This species originated in Europe. It is commercially cultivated in America, France, South Africa, Yugoslavia, Hungary, England, Thailand, Vietnam and Bulgaria. In India, it is commercially cultivated annually in tarai regions (Vaze et al. 1999 and Bhattacharjee, 2000) with Uttar Pradesh and Punjab as leading states. The herb yield, essential oil 0.5-1.5%, containing 56% menthol and 4% esters (Bhatia 1983; Breslow 1965; Chopra et al.,

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

1956; Kapoor 1990; Kirtikar and Basu, 1984; Roberto 1984 and Verghese 1982). The peppermint oil has fine odour and posses carminative, antiseptic, preservative and gastrostimulant properties. There are several pharmaceutical preparations of mint. It is used in lotions and fomentations, externally as a resolvent for bruises and scabies. The plant distilled in water or syrup made from it are recommended for treatment of vomiting in children and for gout. The essence is also applied for toothache and swollen gum. It is administrated in serious nervous disorders in headaches, collics nervous vomiting and tympanitis, hiccups, flatulence and periodic discharges with nervous symptoms. As a flavoring agent peppermint is used in wide range of pharmaceuticals, confectionary, alcoholic drinks, dental creams and mouth washes (Bhattacharjee, 2000; Chopra et al., 1956; Kapoor 1990; Rastogi and Mehrotra, 1993a, 1993b and 1995). The herb synthesize and concentrate oil in its leaves in highly specialized epidermal secretory structures known as glandular trichomes Mc Caskill et al. (1992). The oil from aerial plant parts (mainly foliage) is isolated commerciallly through hydrodistillation, exploiting volatility of the constituent terpenoides (Guenther (1955).

Peppermint Mentha piperita L. (Lamiaceae.) is a high demand aromatic and medicinal crop which is vegetatively propagated through stolon and rhizomes (Verma et al. 2013) Peppermint oil is used both as a medicinal and flavoring agent in foods and confectionery (Milovanovic et al 2009).

Hence it was proposed to conduct field experiments at Agriculture field, G.F. College, Shahjahanpur U.P. during (late Rabi season) year 2015 and 2016 on peppermint crop (Mentha piperita L.) variety “Kosi” to study Integrated Nutrient effect of chemical fertilizer, biofertilizer and organic manures alone and in combination on herb yield and essential oil content of peppermint crop (Mentha peperate L.)

II. MATERIAL AND METHODS

The field experiment was performed during late rabi (winter) season of 2015 on sandy loam soil. This was designed to determine under local conditions the suitability of “Kosi” variety of peppermint (*Mentha piperita* L.) with different doses of recommended fertilizer (RDF), farmyard manure (FYM) and biofertilizer (*Azotobacter spp and Pseudoumonas striata)* treatments and their combinations, each treatment replicated thrice in a simple randomized design on herb and essential oil yield.

Suckers were dipped in captan (0.2%) aqueous pesticides before sowing to make disease free. The row to row distance was kept uniformly at 30.0 cm. The sowing was done on 20 January, 2015, with stolons planted in 5 cm deep furrow. The treatment of fertilizer and manure were given at the time of planting stolons whereas biofertilizers cultures stolons were treated at the rate of 500 kg /ha. The controls were not supplied with any kind of treatment (nutrient). Commercial grade urea, calcium superphosphate and muriate of patash were used as thje respective sources of NPK. The crop was irrigated according to standard agricultural practices during the entire growth period. Weeding was done when required. The harvesting was done on 25 May 2015.

Following Treatments of various nutrients combinations were tested on peppermint crop in year 2015 herb and essential oil yield at harvest only in this field experiment under 5 sq.m. bed size, each treatment replicated thrice. T_1, Control; T_2, FYM @ 20 tonnes/ha; T_3, *Azotobacter spp. + Pseudomonas striata;* T_4, 50% N of RDF

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

+ *Pseudomonas striata;* T_5, 50% P_2O_5 of RDF + *Azotobacter spp.;* T_6, 50% RDF; T_7, 100% RDF; T_8, T_3 + T_6; T_9, T_6 + 10 tonnes FYM/ha; T_{10}, T_3 + T_9; T_{11}, T_3 + T_7; T_{12}, T_2 + T_3 + T_7; T_{13}, T_2 + T_3 + T_6.

III. RESULT AND DISCUSSION

Herb yield was calculated at harvest only (Table-1). Highest herb yield was noted in T_{13} followed by T_{11} , 56.25% and 45.53% more than control (without any treatment) respectively. The lowest value was noted in T_5 and T_{10} respectively. The essential oil content % was noted at harvest only. The highest % was found in T_{13} which was statistically equal to T_{12}, 34.69% more than control (without any treatment) table-14. The next better essential oil % was found in $T_{11.}$ The lowest value was noted in T_5 Genetic constitution is primarily responsible for determining the pattern of plant growth and yield. Nevertheless, these are also markedly influenced by various other factors including available nutrients, climate, cultural practices, population density, season and soil. An ideal combination of these factors ensures optimum yield which has always benn the aim of researchers as well as farmers. Infact, soil is the important source of plant nutrients. When the crop requirements are higher than the soil supplying power, nutrients are applied as manures or fertilizer or both. Manures are plant and animal wastes that are used as sources of plant nutrients. They release nutrients after their decomposition. Manures can be grouped into bulky organic manures and concentrated organic manures based on concentration of the nutrients. Bulky organic manures contain small percentage of nutrients and they are applied in large quantities. Farmyard manure (FYM), compost and green manure are the most important and widely used bulky organic manures. Publications on these lines with regard to peppermint, an important cash and essential oil crop among the crop plants necessitating periodical researches above result corroborates finding of Azaldeen (2013), Mehboobeh et al (2014)

Table-1 Effect of different treatments on herb yield (t/ha) at harvest in Peppermint (*Mentha piperita* L.)

(Mean of three replicates)

herb yield (t/ha)		
Treatments		
1. T_1, Control		11.20
2. T_2, FYM @ 20 tonnes/ha		14.90
3. T_3, *Azotobacter* spp. + *Pseudomonas striata*		16.28
4. T_4, 50% N of RDF+ *Psuedomonas striata*		15.30
5. T_5, 50% P_2O_5 of RDF + *Azotobacter spp.*		13.20
6. T_6, 50% RDF		14.50

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

7. T_7, 100% RDF		15.30
8. T_8, T_3 + T_6		15.65
9. T_9, T_6 + 10 tonnes FYM/ha		14.10
10. T_{10}, T_3 + T_9		13.90
11. T_{11}, T_3 + T_7		16.30
12. T_{12}, T_2 + T_3 + T_7		16.25
13. T_{13}, T_2 + T_3 + T_6		17.50
Mean		14.95
C.D. at 5%	1.120*	
* Significant		

Table-2 Effect of different treatments on essential oil content (%) at harvest in Peppermint (*Mentha piperita* L.)

(Mean of three replicates)

Essential oil content (%)

Treatments		
1. T_1, Control		0.32
2. T_2, FYM @ 20 tonnes/ha		0.39
3. T_3, *Azotobacter* spp. + *Pseudomonas striata*		0.36
4. T_4, 50% N of RDF+ *Psuedomonas striata*		0.39
5. T_5, 50% P_2O_5 of RDF + *Azotobacter spp.*		0.35
6. T_6, 50% RDF		0.42
7. T_7, 100% RDF		0.41
8. T_8, T_3 + T_6		0.49
9. T_9, T_6 + 10 tonnes FYM/ha		0.45

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

10. T_{10}, $T_3 + T_9$		0.45
11. T_{11}, $T_3 + T_7$		0.47
12. T_{12}, $T_2 + T_3 + T_7$		0.49
13. T_{13}, $T_2 + T_3 + T_6$		0.49
Mean		0.43
C.D. at 5%	0.013*	
* Significant		

IV. ACKNOWLEDGEMENT

Authors are highly thankful to Dr. Jitendra Yadav, Registrar, Dr. Anil Midda, Research Head and Dr. Komal Lata Nagpal, Associate Professor, OPJS University churu, Rajasthan as a supervisor for their regular and constant help throughout the course of study and in the preparation of Ph.D. thesis the first author Mohd Abdur Rahman is also thankful to Dr. Zafar Abbas, Associate Professor, G.F. College, Shahjahanpur (U.P.) as a Co-supervisor to provide field and labs facility and proper guidance in this work.

REFERENCES

[1]. Azaldeen, B.H. (2013) Effect of organic fertilizers, and chelated Iron (Fe-EDTA) on growth, chemical contents and active substances in Mint plant (*Mentha piperita* L). Ph.D. thesis Tikrit Univeristy, Tikrit.

[2]. Bhatia, S.C. (1983) Essential oils and perfumery chemicals. Shree Publishing House, Ajmeri gate, New Delhi, pp 45.

[3]. Bhattacharjee, S.K. (2000). Handbook of Medicinal Plants. (Pointer publishers, Jaipur, India, pp 220-222.

[4]. Breslow, R. (1965) The molecules of nature. W.A. Benjamin Incorporation, Massachusetts, London.

[5]. Chopra R.M., nagar SL and Chopra I.C. 1956, Glossary of Indian Medicinal (Publication and information directorate council of scientific and industrial research new delhi). pp 256-257

[6]. Guenther, E. (1955). The essential oils, vol, 1, New York: Van Nostrand, pp 316-319.

[7]. Kapoor, L.D. (1990). Hand book of Ayurvedic Medicinal Plants. CRC Press, Inc. Boca Raton, Florida, p 227.

[8]. Kirtikar, K.R. and Basu, B.D. (1984) Indian Medicinal Plants. Bishen singh and Mahendra pal singh, New connaught place, Dehradun 1980-1981.

[9]. Mahboobeh, Z. Morteza, A. S., Mryam, T. and Reza, S. A. (2014) Effects of organic and chemical fertilizers on quantitative and qualitative characteristics of peppermint (Mentha piperita-L.). International Journal of Agriculture and Crop Sciences, 7: 237-244.

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

[10]. Mc Caskill, D., Gershenzon, J and Croteau, R. (1992) Morphology and monoterpene biosynthetic capabilities of secretory cell clusters isolated from glandular trichomes of Peppermint (Mentha piperita L.). Planta, 187: 445-454.

[11]. Milovanovic. M, Banjac N, Vucelic-Radovic, B (2009) Functional food: rare herbs, seeds and vegetable oils as sources of flavors and phytosterols. J Agric. Sci. (Belgrade), 54: 80-93.

[12]. Rastogi, R.P. and Mehrotra B.N. (1993a) Compendium of Indian Medicinal Plants, 1960-1969. CDRI, Lucknow and Publication and Information Directorate, New Delhi, pp. 272-273.

[13]. Rastogi, R.P. and Mehrotra, B.N. (1993b) Compendium of Indian Medicinal Plants 1970-1979, CDRI Lucknow and Publication and Information Directorate, New Delhi, pp. 455-456.

[14]. Rastogi, R.P. and Mehrotra, B.N. (1995) Compendium of Indian Medicinal Plants 1980-1984, CDRI Lucknow and publication and Information Directorate, New Delhi, pp. 420-421.

[15]. Roberto, C (1984). The McDonald Encyclopedia of Medicinal Plants. serial No. 195. McDonald & Company, worship street, London.

[16]. Vaze, S.V., Kumar, S. (ed) Kukreja, A.K. (ed), Dwivedi, S (ed), Singh, A.K. (1999) Proceedings of the national seminar on the research and development m aromatic plants. Current trends in biology uses, produc tion and marketing of essential oils, Lucknow, India, 30-31 July 1999, Journal of Medicinal and Aromatic Plants (2000), 22:1B, 186-191.

[17]. Verghese, J(1982) Terpene chemistry. Tata McGraw Hill publishing Co., Ltd., New Delhi, pp 18-20.

[18]. Verma, R.K., Chauhan, A., Verma, R.S., Rahman, L.U. and Bisht, A. (2013). Improving production potential and resources use efficiency of Pep permint(*Mentha piperita* L.) intercropped with geranium (*Pelargo-nium graveolens* L.) under different plant density. Indus Crop Prod. 44: 577-582.