Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
www.phytojournal.com
JPP 2021; 10(1): 1847-1851
Received: 25-10-2020
Accepted: 05-12-2020

Gopitha G
Research Scholar, Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore, Tamil Nadu, India

M Kannan
Professor, Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore, Tamil Nadu, India

A Sankari
Associate Professor, Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore, Tamil Nadu, India

R Santhi
Professor, Department of Soil Science and Agricultural Chemistry, TNAU, Coimbatore, Tamil Nadu, India

Corresponding Author:
Gopitha G
Research Scholar, Department of Floriculture and Landscape Architecture, HC&RI, TNAU, Coimbatore, Tamil Nadu, India

Effect of integrated nutrient management on flower quality and physiological parameters of *Nerium* (*Nerium oleander* L.)

Gopitha G, M Kannan, A Sankari and R Santhi

DOI: https://doi.org/10.22271/phyto.2021.v10.i1z.13616

Abstract
The present experiment was under taken to study the effect of integrated nutrient management approach on flower quality and physiological parameters of *Nerium* (*Nerium oleander* L.) at Department of Floriculture and Landscape Architecture, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore. One year old pruned plants of three *Nerium* cultivars (Red, White and Pink) were planted at a spacing of 3×1m accomodating five plants per plot. Among the parameters studied, under ambient condition, treatment T_6 (NPK @ 90:120:120 g/plant/year + Farm Yard Manure + Azospirillum + Phosphobacteria) marked the longest shelf life (4 days) and under cold storage condition, the treatment T_8 (NPK @ 90:120:120 g/plant/year + Vermicompost + Azospirillum + Phosphobacteria) and T_{10} (NPK @ 85:85:85 g/plant/year) had the longest shelf life of 6.9 days. Among all the nutrients, organic manures and their combinations, treatments T_7 *i.e.*, NPK 120:160:160 g plant^{-1} year^{-1} along with farmyard manure and biofertilizers exhibited better performance with respect to physiological characters *viz*., leaf area (38.03 cm^2), total chlorophyll content (5.560 mg g^{-1}), chlorophyll “a” content (2.864 mg g^{-1}) and chlorophyll “b” content (1.599 mg g^{-1}) and total soluble protein content (132.69 mg g^{-1}) while the highest relative water content of 50.68 mg was recorded in treatment of NPK @ 150:200:200 g/plant/year (T_3). Hence the results by the application of inorganic fertilizers combined with organic manures and biofertilizers proved to be a better option for enhancing the flower quality and physiological characters in one year old pruned plants of *Nerium* (*Nerium oleander* L.) as compared to the application of inorganic fertilizers alone.

Keywords: *Nerium*, biofertilizers, shelf life, chlorophyll, soluble protein

Introduction
Nerium oleander L. is an evergreen shrub of immense ornamental significance belonging to the family Apocyanaceae. The incontrovertible aesthetical worth, in hand with tolerance to drought, brackish winds and air pollution makes the *Nerium*, an exceedingly useful plant in all types of urban arrangements, gardens, parks and motorway median floorings widely (Pagen, 1988). It is used for screening, hedging along highways and planting along beaches owing to its salinity tolerance. It is indigenous to northern Africa and the eastern Mediterranean basin along watercourses, gravely places and damp ravines (Bailey, 1976) [1]. The leaves of *Nerium* oleander are about 5 to 20 cm long, acuminate or acute angled, narrow, with a coriaceous dark-green blade and short petiole. Flowers are produced in terminal cluster cyme, about 5 cm in diameter with five petals and different colours vary from lilac, salmon, carmine, deep to pale pink, purple, copper, red, orange, white and yellow (Sinha and Biswas, 2016) [13]. *Nerium* is a heavy feeder of nutrients which requires NPK in large quantities, both in the form of organic and inorganic fertilizers. In present days, nutrient management is viewed skeptically in relation to the sustainable horticulture and environment perfection. Though total organic farming may be a desirable proposition for improving the quality of horticultural produce and soil health, it is difficult to convene the nutrient necessity of the crops, exclusively through organic farming. The use of organic manures and bio-fertilizers along with the balanced use of chemical fertilizers has been proven to improve the physico-chemical and biological properties of soil, besides improving the efficiency of applied chemical fertilizers (Verma *et al*., 2012) [14]. The proper development and quality of flowers are greatly prejudiced by several edaphic factors like soil type and accessibility of nutrients. Exploitation of the synergistic effect of entire potential of organic manures, composts, crop residues, biofertilizers with chemical fertilizers is imperative for improving reasonable nutrient supply (Wani *et al*., 2016) [15]. The overall strategy for increasing flower yield and sustainability of *Nerium* production must have

an integrated approach for nutrient management as a part of it. Since, *Nerium* has become an important loose flower crop among the South Indian farmers, its nutritional requirement under pruning condition is investigated for commercial flower production.

Materials and Methods

The experiment was carried out at Botanic garden, Department of Floriculture and Landscaping, Horticultural College and Research Institute, Tamil Nadu Agricultural University, Coimbatore during 2017-2018. The experiment was laid out in randomized block design with ten treatments and three replications. Generally, flowering commences throughout the year and the peak flowering is during April to August. One year old *Nerium* cultivars planted at a spacing of 3×1 m that were pruned to a height of 90 cm from the base were subjected to different treatments as per the treatments designed for the experiment. The different treatments are T_1 (NPK 90:120:120 g plant^{-1} year^{-1}), T_2 (NPK 120:160:160 g plant^{-1} year^{-1}), T_3 (NPK 150:200:200 g plant^{-1} year^{-1}), T_4 (NPK 90:120:120 g plant^{-1} year^{-1} through nutrient pellets), T_5 (NPK 120:160:160 g plant^{-1} year^{-1} through nutrient pellets), T_6 (NPK 90:120:120 g plant^{-1} year^{-1} + FYM + Azospirillum + Phosphobacteria), T_7 (NPK 120:160:160 g plant^{-1} year^{-1} + FYM + Azospirillum + Phosphobacteria), T_8 (NPK 90:120:120 g plant^{-1} year^{-1}) + Vermicompost + Azospirillum + Phosphobacteria), T_9 (NPK 120:160:160 g plant^{-1} year^{-1} + Vermicompost + Azospirillum + Phosphobacteria) and T_{10} (NPK 85-85-85 g plant^{-1} year^{-1}) as control. Organic manures and biofertilizers, NPK fertilizers respectively were mixed and applied in the pits of 10 cm depth, 20-30 cm from the basal portion of the plant. The quantity and type of manures and fertilizers applied in four splits in a year were as per the treatments of respective plots. Cultural practices were kept uniform for all the treatments and standard practices of cultivation were adopted. In each replications, three plants were selected in all treatments and tagged for recording the observation in flower quality and physiological parameters. The flower quality observations recorded were shelf life, flower diameter and flower bud length and physiological parameters were leaf area, relative water content, chlorophyll content and total soluble protein content. Shelf life was observed by placing flowers in polythene bag of 200 gauge thickness with 4% ventilation. The flowers placed in the packing materials were stored in ambient temperature (25 ±2 °C) and cold storage (4-7 °C). The post harvest shelf life of the flowers was observed and expressed in days. Larger leaves from the shoot on 150th days after pruning were taken for measuring leaf area using Bio-Vis software and equipment and expressed in square centimeter (cm^2). The relative water content of leaves was calculated as per the method of (Barrs and Weatherley, 1962) to find out the percentage of water held by leaves relative to fully turgid tissue. The chlorophyll "a", "b" and total chlorophyll content was estimated in a fully expanded leaf from the top at specified phenophases by following the procedure of (Hiscox and Israelstam, 1979) and the contents expressed as mg per g of fresh tissue. The protein content in the enzyme extract of the leaves was estimated by the method of (Lowry *et al.*, 1951) and expressed in mg g^{-1} on fresh weight basis. The statistical analysis was done by adopting the standard procedures of Panse and Sukhatme (1985). The critical difference was worked out at five per cent (0.05) probability. Analysis was carried out with SPSS software package and MS Excel® spreadsheet.

Result and Discussion

Flower quality parameters

A perusal of data embodied in table 1 revealed that integrated nutrient combinations in *Nerium* showed significant differences on shelf life among the packed flowers in the ambient temperature (28±2 °C) and refrigerated condition (7 °C). Amid the treatments under ambient condition, treatment T_6 (NPK @ 90:120:120 g/plant/year + Farm Yard Manure + Azospirillum + Phosphobacteria) marked the longest shelf life (4 days) while the lowest shelf life was noted in the treatment T_3 (NPK @ 150:200:200 g/plant/year). Under cold storage condition, the treatment T_8 (NPK @ 90:120:120 g/plant/year + Vermicompost + Azospirillum + Phosphobacteria) and T_{10} (NPK @ 85:85:85 g/plant/year) had the longest shelf life of 6.9 days and the shortest shelf life in the treatment T_3 (NPK @ 150:200:200 g/plant/year). The quality character of any loose flower is dependent primarily on the increase in shelf life. Increased shelf life might be attributed to the application of potassium which was associated with carbohydrate metabolism and translocation as well as stimulation of water uptake which in-turn enhanced the longevity of tuberose flower (Talukdar *et al*., 2003) [11]. Addition of organic manures altered the nutrient availability and water release pattern of the soil. As a result, slow and steady release of nutrients and moisture to the plant would have helped in maintenance of turgor in the leaf and flower. The results were in agreement with the results of Chauhan and Pansuriya (2015) [3].

The flower bud length and flower diameter was not favourably altered by various nutrient and integrated nutrient management practices in *Nerium*. The results on the flower bud length and flower diameter showed no statistical significance among the treatments (table 1). The highest flower bud length (3.28 cm) and flower diameter (4.87 cm) was observed in the treatment T_7 (NPK @ 120:160:160 g/plant/year + Farm Yard Manure + Azospirillum + Phosphobacteria).

Physiological parameters

Leaf area measured were displayed in the table 2, showed significantly different values among the treatments. The treatment T_7 (NPK @ 120:160:160 g/plant/year + Farm Yard Manure + Azospirillum + PSB) recorded considerably higher leaf area (38.03 cm^2) and followed by the treatment T_8 (NPK @ 90:120:120 g/plant/year + Vermicompost + Azospirillum + PSB) of the value 31.91 cm^2 and the treatment T_1 (NPK @ 90:120:120 g/plant/year) registered the lowest leaf area (19.09 cm^2) as shown in Figure 1. Regarding the observations on the relative water content in the leaves of *Nerium* plants subjected to nutrient treatments, significant results were presented in table 2. Among the treatments, the highest relative water content of 50.68 mg was recorded in treatment of NPK @ 150:200:200 g/plant/year (T_3) while the lowest relative water content (35.23 mg) was observed in the treatment T_5 which received NPK @120:160:160 g /plant/year through nutri-pellets.

Significant increase in the chlorophyll content and total soluble protein content was observed in the treatments of combined organic and inorganic nutrient along with biofertilizers (table 3). Higher total chlorophyll content (5.560 mg g^{-1}), chlorophyll "a" content (2.864 mg g^{-1}) and chlorophyll "b" content (1.599 mg g^{-1}) was observed in the treatment T_7 (NPK @ 120:160:160 g/plant/year + Farm Yard Manure + Azospirillum + Phosphobacteria) followed by the treatment T_3 (NPK @ 150:200:200 g/plant/year) with the values of 2.640, 1.236 and 4.298 mg g^{-1} of chlorophyll "a", chlorophyll "b" and total chlorophyll content respectively (Figure 2). The lowest chlorophyll "a" content (2.164 mg g^{-1}) recorded in the treatment T_1 (NPK @ 90:120:120 g/plant/year) whereas chlorophyll "b" (0.806 mg g^{-1}) and total chlorophyll content (2.803 mg g^{-1}) in the treatment T_{10} (NPK @ 85:85:85 g/plant/year). Total soluble protein content estimated was highest in the treatment T_7 (NPK @ 120:160:160 g/plant/year + Farm Yard Manure + Azospirillum + Phosphobacteria) recorded 132.69 mg g^{-1} followed by the treatment T_3 (NPK @ 150:200:200 g/plant/year) with the value 128.23 mg g^{-1}. The treatment T_{10} (NPK @ 85:85:85 g/plant/year) was observed with the lowest total soluble protein content (73.44 mg g^{-1}).

The outcome of production of phytohormones by the living organisms in biofertilizers is improvement in the availability of nutrients and accumulation of photosynthates which ultimately increase the photosynthetic surface (Martin and Prevel, 1981) [10]. The leaf area results are in harmony with the findings of Geeta *et al*., (2016) [4] in China aster. Increased total chlorophyll content was recorded in the treatment T7 (NPK @ 120:160:160g/plant/year + Farm Yard Manure + Azospirillum + PSB) may be due to supply of the organic manures rich with the essential elements for chlorophyll formation such as nitrogen, magnesium and others (Gomaa and Abou-Aly, 2001) [5]. Similar results were obtained by Hassan (2009) [6] in *Hibiscus sabdariffa* and Jayamma *et al*., (2014) [8] in *Jasminum auriculatum* that application of biofertilizers along with 50 per cent of NPK was on par with 100 per cent NPK fertilizer with respect to chlorophyll content.

Table 1: Effect of integrated nutrient combinations on flower quality attributes of nerium (*Nerium oleander* L.)

Treatments	Shelf life		Flower bud length (cm)	Flower diameter (cm)
	Ambient (28 ±2 °C)	Cold Storage (7°C)		
T_1 - NPK @ 90:120:120 g/plant/yr	3	5.37	3.15	4.25
T_2 - NPK @120:160:160 g/plant/yr	2.37	5.65	3.07	4.41
T_3 - NPK @150:200:200 g/plant/yr	2.2	5.12	3.13	4.38
T_4 - T_1(NPK @ 90:120:120 g/plant/yr) through Nutri-pellets	3.95	6.23	3.17	4.07
T_5 - T_2(NPK@ 120:160:160 g/plant/yr) through Nutri-pellets	2.85	5.85	3.23	4.47
T_6 - T_1(NPK@ 90:120:120 g/plant/yr) + FYM + Azospirillum+ PSB	4	6.75	3.23	4.50
T_7 - T_2(NPK@120:160:160 g /plant/yr) + FYM + Azospirillum + PSB	3.03	6.5	3.28	4.87
T_8 - T_1(NPK@ 90:120:120 g/plant/yr) + Vermicompost + Azospirillum + PSB	3.54	6.89	3.25	4.61
T_9 - T_2(NPK@ 120:160:160 g/plant/yr)+Vermicompost + Azospirillum + PSB	3.13	6	3.20	4.42
T_{10} - NPK @ 85-85-85 g/plant/yr (Control)	3.68	6.88	3.10	4.41
Mean	3.18	6.12	3.18	4.44
SEd	0.068	0.13	0.07	0.23
CD (p=0.05)	0.14	0.27	0.14 (NS)	0.48(NS)

*FYM = Farm Yard Manure. PSB = Phosphate Solubilizing Bacteria

Table 2: Effect of nutrient combinations on leaf area and relative water content in nerium (*Nerium oleander* L.)

Treatments	Leaf area (cm^2)	Relative water content (mg)
T_1 - NPK @ 90:120:120 g/plant/yr	48.44	19.09
T_2 - NPK @120:160:160 g/plant/yr	49.48	22.03
T_3 - NPK @150:200:200 g/plant/yr	50.68	21.91
T_4 - T_1(NPK @ 90:120:120 g/plant/yr) through Nutri-pellets	38.86	23.15
T_5 - T_2(NPK@ 120:160:160 g/plant/yr) through Nutri-pellets	35.23	19.88
T_6 - T_1(NPK@ 90:120:120 g/plant/yr) + FYM + Azospirillum+ PSB	39.80	26.25
T_7 - T_2(NPK@120:160:160 g /plant/yr) + FYM + Azospirillum + PSB	45.96	38.03
T_8 - T_1(NPK@ 90:120:120 g/plant/yr) + Vermicompost + Azospirillum + PSB	45.03	31.91
T_9 - T_2(NPK@ 120:160:160 g/plant/yr) + Vermicompost + Azospirillum + PSB	39.86	28.96
T_{10} - NPK @ 85-85-85 g/plant/yr (Control)	43.00	20.48
Mean	43.64	19.09
SEd	0.820	0.357
CD (p=0.05)	1.723	1.025

*FYM = Farm Yard Manure; PSB = Phosphate Solubilizing Bacteria

Table 3: Effect of nutrient combinations on chlorophyll and total soluble protein content in nerium (*Nerium oleander* L.)

Treatments	Chlorophyll a (mg g^{-1})	Chlorophyll b (mg g^{-1})	Total Chlorophyll (mg g^{-1})	Total Soluble Protein content (mg g^{-1})
T_1 - NPK @ 90:120:120 g/plant/yr	2.164	0.929	3.230	91.774
T_2 - NPK @120:160:160 g/plant/yr	2.300	1.002	3.312	98.051
T_3 - NPK @150:200:200 g/plant/yr	2.640	1.236	4.298	128.231
T_4 - T_1(NPK @ 90:120:120 g/plant/yr) through Nutri-pellets	2.391	0.920	3.196	57.692
T_5 - T_2(NPK@ 120:160:160 g/plant/yr) through Nutri-pellets	2.420	1.107	3.850	71.539
T_6 - T_1(NPK@ 90:120:120 g/plant/yr) + FYM + Azospirillum+ PSB	2.208	0.952	3.486	115.064
T_7 - T_2(NPK@120:160:160 g /plant/yr) + FYM + Azospirillum + PSB	2.864	1.599	5.560	132.692
T_8 - T_1(NPK@ 90:120:120 g/plant/yr) + VC + Azospirillum + PSB	2.382	0.919	3.202	117.258
T_9 - T_2(NPK@ 120:160:160g/plant/yr) + VC + Azospirillum + PSB	2.569	1.122	3.902	124.908

T_{10} - NPK @ 85-85-85 g/plant/yr (Control)	2.337	0.806	2.803	73.440
Mean	2.428	1.059	3.684	101.065
SEd	0.045	0.026	0.073	1.876
CD (p=0.05)	0.094	0.054	0.153	3.94

*FYM = Farm Yard Manure; VC = Vermicompost; PSB = Phosphate Solubilizing Bacteria

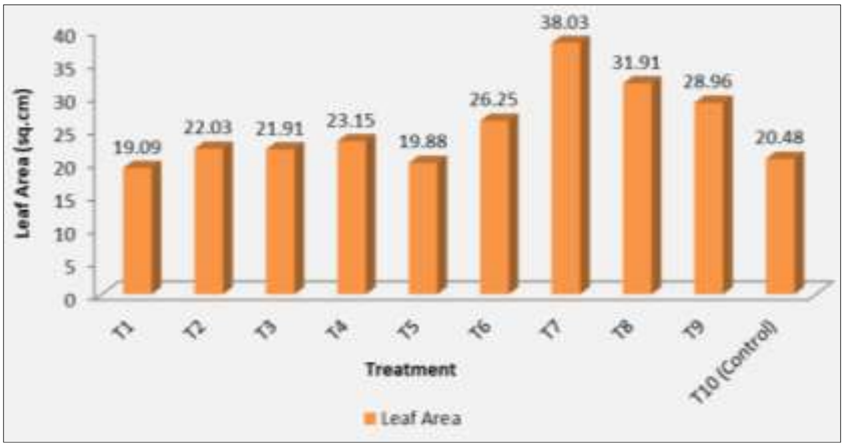
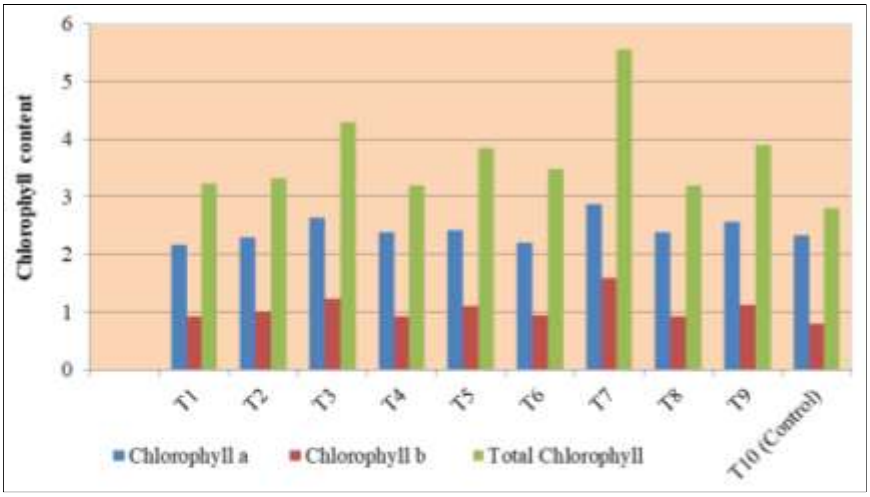


Fig 1: Effect of nutrient combinations on leaf area (cm^2) in nerium (*Nerium oleander* L.)



T_1NPK @ 90:120:120 g/plant/yr T_6 T_1 + FYM + Azospirillum+ PSB
T_2NPK @120:160:160 g/plant/yrT_7 T_2 + FYM + Azospirillum + PSB
T_3NPK @150:200:200 g/plant/yrT_8 T_1 + VC + Azospirillum + PSB
T_4T_1 through Nutri-pellets T_9 T_2 + VC+ Azospirillum + PSB
T_5T_2 through Nutri-pellets T_{10}NPK @ 85-85-85 g/plant/yr

Fig 2: Effect of nutrient combinations on chlorophyll content (mg g^{-1}) in nerium (*Nerium oleander* L.)

References

1. Bailey Hortus L. Third: A concise dictionary of plant cultivated in US and Canada 1976.
2. Barrs H, Weatherley P. A re-examination of the relative turgidity technique for estimating water deficits in leaves. Australian Journal of Biological Sciences 1962;15(3):413-428.
3. Chauhan RV, Pansuriya PB. Effect of integrated nutrient management on growth, yield and quality of Gladiolus (*Gladiolus grandiflorus* L.) cv. Psittacinus Hybrid. Journal of Horticulture 2015;02(02):9-11. doi:10.4172/2376-0354.1000129
4. Geeta BL, Mahadevamma M, Raj L, Totad M. Influence of NPK and bio fertilizers on growth, yield and quality of China aster (*Callistephus chinensis* (L.) Nees) for cut flower production 2016, 2-4.
5. Gomaa A, Abou-Aly H. Efficiency of bioferitlization in the presence of both inorganic and organic fertilizers on growth, yield and chemical constituents of anise plant (*Pimpinella anisum* L.). Paper presented at the Proc. 5th Arabian Hort. Conf. March 2001.
6. Hassan F. Response of *Hibiscus sabdariffa* L. plant to some biofertilization treatments. Annals of Agricultural Science (Cairo) 2009;54(2):437-446.
7. Hiscox JT, Israelstam G. A method for the extraction of chlorophyll from leaf tissue without maceration. Canadian journal of botany 1979;57(12):1332-1334.
8. Jayamma N, Naik NM, Jagadeesh K. Influence of biofertilizer application on growth, yield and quality parameters of jasmine (*Jasminum auriculatum*). Paper presented at the International conference on food, biological and medical sciences (FBMS-2014) 2014.
9. Lowry OH, Rosebrough NJ, Farr AL, Randall RJ. Protein measurement with the Folin phenol reagent. Journal of biological chemistry 1951;193(1):265-275.
10. Martin Prevel P. The role of the nutrient element in plants potash review. J Abridged from fruits 1981;33(7-8):521-529.

11. Talukdar MC, Baruah N, Mahanta S. Response of graded levels of NPK on yield and quality of tuberose (*Polianthes tuberosa* L.). Journal of Ornamental Horticulture 2003;6(4):335-340.
12. Panse NG, Sukhatme PV. Statistical methods for Agricultural workers. ICAR. New Delhi 1985.
13. Sinha SN, Biswas K. A concise review on *Nerium oleander* L. An important medicinal plant 2003, 408-412.
14. Verma S, Angadi S, Patil V, Mokashi A, Mathad J, Mummigatti U. Growth, yield and quality of chrysanthemum (*Chrysanthemum morifolium* Ramat.) cv. Raja as influenced by integrated nutrient management. Karnataka Journal of Agricultural Sciences 2012;24(5).
15. Wani SA, Ali T, Chand S, Sofi KA. Improving soil health and productivity in brown sarson var. KS-101 (*Brassica rapa* L.) in alfisols of temperate Kashmir through organic and inorganic nutrient sources. Ecol. Environ. Conservation 2016;22:2.