Original Research Article

Effect of different treatment modules on seed yield and quality in African marigold(*Tagetes erecta*L.)

ABSTRACT

The present investigation was carried out at the Department of Seed Science and Technology experimental farm, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP)-173 230 during 2018 and 2019. The treatment modules comprising different doses of Jeevamrit applied as a drench (25ml/m^2, 50ml/m^2,75ml/m^2 and 100 ml/m^2) and as a foliar spray (5%, 10%, 15% & 20%) at 15 days interval, alternatively + Brahmastra @ 2.5 % and Neemastra @ 2.5 % at 7 days interval, alternatively along with RDF, untreated control and an organic module based on *Trichoderma viride*. The field experiment was conducted in Randomized Block Design (RBD) with 19 treatments replicated thrice. Although maximum values for number of seeds per capitulum (268.12), seed yield per plant (14.74 g), seed yield per plot (176.90 g), seed yield per hectare (327.59 kg), 1000 seed weight (2.56 g), seed germination (85.13 %), seedling length (12.66 cm), fresh seedling weight (0.55 g),dry seedling weight (7.78 mg), SVI-I (1077.68), SVI-II (662.55) were recorded in M_{18} (RDF (100% NPK) + FYM @ 5 kg/m^2),it was found to be statistically at par with the treatment module M_{16} (Drenching with Jeevamrit @ 100 ml/m^2 + Foliar application of Jeevamrit @ 20 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively)which had highest speed of germination (33.36).

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***Keywords*:** African marigold, natural farming, RDF, seed yield, seed quality parameters

INTRODUCTION

Marigold (*Tagetes spp*. L.) is an important commercial annual flower belonging to the family Asteraceae and is native to Central and South America, especially Mexico.In India, marigold is commercially grown to produce loose flowers for making garlands and traditionally for offerings in temples, churches and other places of worship, besides their use in landscapes and environment friendly. The continuous and indiscriminate use of inorganic fertilizers and pesticides ~~which~~are not only hazardous to ~~the~~human beings but also degradesthe environment and ecosystems, besides degrading the health of the soil. So much so, the indiscriminate and continuous use of chemical fertilizers under intensive cropping systems has led to disturbance in the ecosystems and created an imbalance of nutrients in the soil, adversely affectingthe health and fertility status of the soil. Consequently, the plant growth, flowering, seed yield, and seed quality are deteriorating. Therefore, using organic farming systems or natural farming systems based on Zero Budget concept could be suitable and viable alternatives to combat the challenges posed by the farming systems employing chemical fertilizers and pesticides for increasing the seed yield and quality attributes.

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In the Subhash Palekar Natural Farming Systems (SPNF), plants' nutritional requirements and protection from insect pests and diseases are mostly met with the applications of some on-farm products like Jeevamrit, Beejamrit, Neemastra, Agniastra, and Brahmastra*etc.*These products are prepared by mixing and fermenting a small amount of dung and urine of an indigenous or *desi* cow, a handful of undisturbed soil from the field bunds or underneath a tree, a chunk of jaggery and pulse flour *etc*., including the leaves and other parts of plants particularly possessing medicinaland pesticidal properties. The different products (Beejamrit, Jeevamrit, Agniastra, Neemastra and Brahmastra*etc.*) used in Subhash Palekar Natural Farming Systems do not just serve as sources of nutrients but also enrichthe soil with a huge amount of microbial loads leading to enhancing the soil bio-mass when applied in the soil. These products act as tonics and ultimately improve soil health, besides increasing ~~the~~ growth, seed yield and seed quality (Vasanthkumar, 2006).

In Northern India, particularly in~~the state of~~ Himachal Pradesh, the climatic conditions are quite favourable for seed production with better quality~~of~~marigolds. The cultivation of different flower crops for fresh flowers in marigoldsemploying Subhash Palekar Natural Farming Systems (SPNF) seems to be one of the viable options to reduce the use of chemical fertilizersand pesticides along withthereduction in the cost of cultivation vis-a-vis improving the health and fertility status of the soil.

MATERIALS AND METHODS

The present investigationwas carried out at the Khaltoo experimental farm and laboratory of the Department of Seed Science and Technology, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan(HP)during 2018 and 2019 for two years. The field experiment comprising 19 treatment modules was laid out in Randomized Block Design having three replications and laboratory studies in Completely Randomized Design with four replications. The cultivar used was ‘PusaNarangiGainda’.The plot size was 2.40 × 1.80 m with spacing of60 × 60 cm. The details of the experiment were as under:

Table 1. Details of treatment modules

Module-1 (M_1)	Drenching with Jeevamrit @ 25 ml/m^2 + Foliar application of Jeevamrit @ 5 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-2 (M_2)	Drenching with Jeevamrit @ 25 ml/m^2 + Foliar application of Jeevamrit @ 10 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-3 (M_3)	Drenching with Jeevamrit @ 25 ml/m^2 + Foliar application of Jeevamrit @ 15 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-4 (M_4)	Drenching with Jeevamrit @ 25 ml/m^2 + Foliar application of Jeevamrit @ 20 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-5	Drenching with Jeevamrit @ 50 ml/m^2 + Foliar application of Jeevamrit

(M_5)	@ 5 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-6 (M_6)	Drenching with Jeevamrit @ 50 ml/m^2 + Foliar application of Jeevamrit @ 10 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-7 (M_7)	Drenching with Jeevamrit @ 50 ml/m^2 + Foliar application of Jeevamrit @ 15 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-8 (M_8)	Drenching with Jeevamrit @ 50 ml/m^2 + Foliar application of Jeevamrit @ 20 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-9 (M_9)	Drenching with Jeevamrit @ 75 ml/m^2 + Foliar application of Jeevamrit @ 5 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-10 (M_{10})	Drenching with Jeevamrit @ 75 ml/m^2 + Foliar application of Jeevamrit @ 10 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-11 (M_{11})	Drenching with Jeevamrit @ 75 ml/m^2 + Foliar application of Jeevamrit @ 15 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-12 (M_{12})	Drenching with Jeevamrit @ 75 ml/m^2 + Foliar application of Jeevamrit @ 20 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-13 (M_{13})	Drenching with Jeevamrit @ 100 ml/m^2 + Foliar application of Jeevamrit @ 5 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-14 (M_{14})	Drenching with Jeevamrit @ 100 ml/m^2 + Foliar application of Jeevamrit @ 10 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-15 (M_{15})	Drenching with Jeevamrit @ 100 ml/m^2 + Foliar application of Jeevamrit @ 15 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-16 (M_{16})	Drenching with Jeevamrit @ 100 ml/m^2 + Foliar application of Jeevamrit @ 20 % at 15 days interval, alternatively + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively
Module-17 (M_{17})	Soil treatment with *Trichoderma* spp. @ 1 kg/q FYM + Foliar application of Neem seed kernel extract and Garlic extract @ 5% each at 15 days interval, respectively
Module-18* (M_{18})	RDF (100% NPK) + FYM @ 5 kg/m^2
Module-19 (M_{19})	Control (Untreated)

*Sprays of Chlorpyriphos (50 EC) @ 1 ml/l and Imidacloprid (17.8 SL) @ 0.5 ml/l at 15 days intervals, alternatively as well as Diathane M-45 @ 2.0 g/l and Bavistin @ 1 g/l at 15 days intervals, alternatively were practiced only in the treatment module M_{18}.

RESULTS AND DISCUSSION

A. Seed Yield Parameters

A perusal of pooled data (Table-2)indicated significant variation among different treatment modules and years of study for number of seeds per capitulum and seed yield.The plants receiving treatment module M_{18} had the highest number of seeds per capitulum (268.12) beingstatistically at par with natural farming modulesM_{16} (266.00) and M_{12} (264.00) as well as organic farming module M_{17} (264.90). The plants producing minimum seeds per captiulum (218.43) were in M_{19}(untreated control). Similarly, the plants receiving the treatment module comprising M_{18} yielded highest (14.74 g/plant, 176.90 g/plot and 327.59 kg/ha) and this seed yield was statistically similar to that produced by the plants raised through natural farming modulesM_{16} (14.62 g, 175.38 g and 324.78 kg, respectively), M_{12} (14.33 g, 171.96 g and 318.44 kg, respectively) and M_{15} (14.13 g, 169.54 g, 176.70 kg, respectively) as well as organic farming module i.e. M_{17} (13.99 g, 167.86 g and 336.30 kg, respectively). The lowest seed yield (7.95 g, 95.40 g and 176.70 kg, respectively) was weighed in M_{19}(untreated control).

The highest number of seeds per capitulum and production of highest seed yield in M_{18} may be due to the availability and more uptake of these nutrients in balanced manner resulting in better growth of the plants which later on produced quality flowers in sufficient number in each plant. Consequently, these flowers upon pollination and fertilization could set sufficient seeds resulting in the development and maturation of good amount of seeds comparatively. Therefore, there was maximum number of seeds per capitulum and production of highest seed yield in each plant and per unit area. Similar results have also been noticed in marigold plants raised with the recommended doses of NPK (Bhat and Stepherd, 2006, Sunitha *et al.*, 2007, Singh *et al.*, 2008, Sharma *et al.*, 2010 and Naik, 2015).

The number of seeds per capitulum and seed yield recorded per plant and unit area in some natural farming modules like M_{16}, M_{12} and M_{15} along with organic farming module (M_{17}) were also statistically comparable with the seed yield obtained in module (M_{18}) and could be as a consequence of better growth of the plants raised through these modules. Consequently, there was production of better quality flowers with maximum count in every plant and later on these flowers upon pollination and fertilization developed more seeds and ultimately accounted for higher seed yield.The present investigation is quite matchable with the findings proclaimed in chilli(Chandrakala, 2008), in sunflower (Manjunatha*et al.*, 2009), in pigeon pea (Baban, 2011),in tomato (Gore and Sreenivasa, 2011), in soybean & wheat (Ugale, 2014) as well as in Field bean (Sidappa, 2015) with augmentation of treatment based on Jeevamrit. Similarly, Pathania (2019) reported highest seed yield per plant in China aster when Jeevamrit was applied through drenching and foliar spray

B. Seed Quality Parameters

1000 seed weight and seed germination(%)

The data enumerated in Table-2 elucidated that application of various natural farming modules of studies exhibited significant effects on 1000 seed weight and seed germination (%) during both the years. The pooled data revealed that the plants receiving treatment module M_{18} recorded maximum weight of 1000 seeds (2.56 g) which was at par with the natural farming modules M_{16} (2.54 g) andM_{15} (2.52 g)as well as organic module M_{17} (2.52 g). Whereas, the lowest 1000 seed weight (2.12 g) was noted inuntreatedcontrol(M_{19}). Although, highest germination percentage of seeds (85.13 %)was noted in the treatment module M_{18} [i.e.RDF (100% NPK) + FYM @5 kg/m^2]but it was found to be statistically similar with the natural farming modules M_{16} (84.00 %) and M_{12} (83.75 %).However, the lowest seed germination (74.75 %) was noticed in M_{19} (untreated control).

The highest 1000 seed weight and seed germination in recommended dose of fertilizer (M_{18}) could be attributed to the significant increase in nutrient supply and uptake by the plants from the soil, which might have witnessed higher dry matter accumulation resulting in the production of bolder and better quality seeds. Hence, an increase in 1000 seed weight and seed germination percentage has been noticed. These results are in conformity with the research recommendations of Sunitha *et al.* (2007) in marigold, Awchar*et al.*(2010) in gaillardia andSaman and Kirad (2013) in calendula. These results have also got supportfrom the findings of Natrajan and Vijayakumar (2002) in marigold cv. African Gaint, who also obtained highest germination of seeds produced with the RDF.

The treatments based on Jeevamrit(M_{16} and M_{12}) have also exhibited 1000 seed weight and seed germination statistically on par with the M_{18} and could be as a consequence of supply of sufficient nutrients as well as other growth promoting organic substances leading to more growth, flowering and ultimately production ofbetter quality seeds by the plants raised with the augmentation of these natural farming modules. Therefore, the seeds harvested from these modules could exhibit higher 1000 weight of seed and germination percentage. The results are statistically comparable with the findings proclaimed in China astercv. 'Kamini'(Pathania, 2019), in okra(Thakur, 2018), in pea (Shailza, 2018),in French bean(Dhananjaya, 2017) and in paddy (Sridhar *et al*., 2011).

Speed of germination andSeedling length (cm):

A perusal of the data presented in Table-3indicated that the application of different natural farming modules had significant effect on speed of germination and seedling length during both the years.The highest speed of seed germination (33.36) was recorded in M_{16} and it was observed to be at par with M_{18} (32.48). Whereas, minimum speed of seed germination (19.63) was found inM_{19}i.e. untreated control. Although, the longest seedlings (12.66 cm) were noted inM_{18} which were found to be statistically similar with natural farming modules M_{16} (12.29 cm), M_{12} (12.15 cm),M_{15} (12.07 cm), M_{14} (11.96 cm), M_{13} (11.84 cm),M_{11} (11.76 cm)and M_{10} (11.69 cm)as well as organic module M_{17} (11.84 cm). However, minimum seedling length (9.72 cm) was exhibited in theuntreated control (M_{19}).

The more seedling length in treatment module M_{18} might be due to the production of bolder and better quality seeds which upon germination could exhibit best quality seedlings recording maximum length. Similarly, best quality seedlings with more length have also been reported by Vijayakumar (2002) and Sunitha *et al.* (2007) in marigold as well as Kumari (2016) in pansy and Kumar *et al.* (2018) in Sweet William.

The treatments based on Jeevamrit(M_{16}, M_{12},M_{15}, M_{14}, M_{13},M_{11} andM_{10})and M_{17} (organic module) also exhibited highest speed of germination and longest seedlings and could be ascribed to the production of better quality seeds in these treatments which upon germination resulted in the production of longer seedlings as well as speed of germination. The present findings have got the support of research recommendations proclaimed in China astercv. 'Kamini'(Pathania, 2019), in okra(Thakur, 2018), in pea (Shailza, 2018) andin French bean(Dhananjaya, 2017).

Seedling fresh weight (g) and Seedling dry weight (mg):

The data dispensed in Table-3indicated that different treatment modules had manifested significant effects on seedling fresh weight and dry weight during both the years of experimentation.The highest seedling fresh weight (0.55 g) was weighed for the seedlings raised from the seed lot obtained from the treatment module M_{18}i.e.RDF (100% NPK) + FYM @5 kg/m^2 and being statistically on par with natural farming modules M_{16} (0.53 g),M_{15} (0.50 g), M_{14} (0.50g) M_{12} (0.50 g), M_{13} (0.49 g) and M_{11} (0.49 g) as well as organic moduleM_{17} (0.52 g). Whereas, lowest seedling fresh weight (0.34 g) was observed inM_{19}i.e. untreated control. Similarly, the maximum dry weight of seedling (7.78 mg) was observed in treatment module M_{18}i.e.RDF (100% NPK) + FYM @5 kg/m^{2}and it was statistically at par with natural farming modules M_{16} (7.71 mg), M_{15} (7.64 mg), M_{12} (7.62 mg), M_{14} (7.62 mg),M_{13} (7.60 mg),M_{11} (7.48 mg),M_{10} (7.38 mg) and M_7 (7.29 mg). The seedling dry weight recorded in the organic treatment moduleM_{17} (7.68 mg) was also statistically similar to the seedling dry weight noted in M_{18}. However, minimum seedling dry weight (6.53 mg) was recorded inM_{19}(untreated control).

The higher seedling fresh weight and dry weight found in M_{18} may be as a consequence of bold and best quality seeds produced in the said treatment which upon germination could prove their superiority in terms of exhibiting better quality seedlings judged in terms of their length and putting up of more fresh weight. So, ultimately recorded highest values for seedling dry weight. So much so, the production of vigorous seedlings also accounts for higher dry matter content of the seedlings leading to the increased seedling fresh anddry weight.These results have got the support from the findings concluded by Vijayakumar (2002) and Sunitha *et al.* (2007) in marigold as well as Kumari (2016) in pansy and Kumar *et al.* (2018) in Sweet William.

The treatment combinations M_{16}, $M_{15,}$$M_{12,}$$M_{14,}$$M_{13,}$$M_{11,}$$M_{10}$ and M_7 which were based on Jeevamrit as well as M_{17} (organic module) have also exhibited higher fresh and dry weight of seedlings and were statistically matchable with the M_{18}. The higher fresh and dry weight of seedlings could be ascribed to the production of better quality seeds in these treatments which upon germination produced longer and better quality seedlings. Upon drying of these seedlings, the dry matter content was weighed to be more comparatively. Hence, higher values for seedlingfresh and dry weight were recorded. These results are in line to the research recommendation of Pathania (2019) in China aster cv. 'Kamini' as well as Dhananjay (2017)in French bean with the application of Jeevamrit.

Seed vigour index-I (Length) and Seed vigour index-II (Mass)

A cursory glance of pooled data (Table-3) indicated that the application of different farming modules have exhibited significant impact on seed vigour index-I and seed vigour index-II in both the years. The highest value for seed vigour index-I (1077.68) was noticed in M_{18}being statistically similar to the natural farming modules M_{16} (1031.71) and M_{12} (1018.36). However, the lowest seed vigour index-I (726.07) was recorded in untreated control (M_{19}). Similarly, the highest seed vigour index-II (662.55) in the inorganic treatment module $M_{18}$was statistically comparable to the natural farming modules M_{16} (647.64), M_{12} (638.45),M_{15} (628.83) andM_{14} (621.22) along with organic module M_{17} (640.93). Whereas, minimum seed vigour index-II (488.15) was recorded inM_{19}i.e. control.

The highest seed vigour index-I& II recorded for the seed lot produced in M_{18} could be due to the better quality of the seeds measured in terms of highest seed germination (%) as well as maximum seedling length and dry weight. Owing to the fact that seed vigour index-I& II is the product of seed germination percentage and seedling length as well as dry weight, so, highest values for seed vigour index-I& II have been obtained. The bold and best quality seeds have been produced when the recommended doses of NPK and FYM were applied by Sunitha *et al*. (2007) in marigold, Kumari (2016) in pansy and Kumar *et al*. (2018) in Sweet William.

The natural farming modules namely $M_{16,}M_{12,}M_{15}$ and M_{14} as well as M_{17} (organic farming module) have also exhibited seed vigour index-I& II statistically similar to the M_{18} which could be as a consequence of production of better quality seeds resulting in more seed vigour index-I& II when these seeds were allowed to germinate and produce seedlings. Pathania (2019) in China aster, Thakur (2018) in okra, Shailza (2018) in pea, Brice (2017) in okra as well as Gadewar*et al*. (2014) in lentil have also claimed higher values for seed vigour index-II with the augmentation of various treatment combinations comprising of Jeevamrit applied through drenching or sprays.

CONCLUSION

From the present investigation, it can be concluded thatthe treatment module M_{18} comprising100% recommended dose of NPK + FYM @5 kg/m^2 though improved seed yield and seed quality attributes in African marigold significantly over untreated control but it was statistically similar to the natural farming module M_{16} (i.e. Drenching with Jeevamrit @ 100 ml/m^2 + foliar application of Jeevamrit @ 20 % at 15 days interval + Neemastra @ 2.5 % and Brahmastra @ 2.5 % at 7 days intervals, alternatively). The natural farming module M_{16}

besides enhancing the seed yield and seed qualityincurred minimum expenditure. Hence, this module can be recommended for seed production of African marigold in the mid-hill conditions of Himachal Pradesh on commercial scale after conducting multi location trials.

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Table 2: Effect of different treatmentmodules on number of seeds per capitulum,seed yield per plant (g), seed yield per plot (g), seed yield per hectare (kg), 1000seed weight (g) and seed germination (%) in African marigold

Modules	Number of seeds per capitulum	Seed yield per plant (g)	Seed yield per plot (g)	Seed yield per hectare (kg)	1000 seed weight (g)	Seed germination (%)
M_1	223.97	8.97	107.66	199.37	2.27	75.63 (8.70)
M_2	225.98	9.20	110.38	204.41	2.30	76.88 (8.77)
M_3	228.90	9.40	112.78	208.85	2.31	77.50 (8.80)
M_4	227.98	10.08	120.90	223.89	2.34	78.63 (8.87)
M_5	225.97	9.78	117.40	217.41	2.35	78.25 (8.85)
M_6	230.90	10.19	122.22	226.33	2.39	78.88 (8.88)
M_7	231.19	10.21	122.46	226.78	2.40	78.38 (8.85)
M_8	232.00	11.37	136.38	252.56	2.43	80.00 (8.94)
M_9	232.70	10.92	131.06	242.70	2.41	79.63 (8.92)
M_{10}	237.33	11.97	143.66	266.04	2.49	79.50 (8.92)
M_{11}	239.90	12.55	150.56	278.81	2.48	80.50 (8.97)
M_{12}	264.00	14.33	171.96	318.44	2.46	83.75 (9.15)
M_{13}	244.50	12.94	155.28	287.56	2.44	80.88 (8.99)
M_{14}	253.10	13.52	162.26	300.48	2.48	81.50 (9.03)
M_{15}	261.20	14.13	169.54	313.96	2.52	82.25 (9.07)
M_{16}	266.00	14.62	175.38	324.78	2.54	84.00 (9.16)
M_{17}	264.90	13.99	167.86	310.85	2.52	83.38 (9.13)
M_{18}	268.12	14.74	176.90	327.59	2.56	85.13 (9.23)
M_{19}	218.43	7.95	95.40	176.67	2.12	74.75 (8.65)
$CD_{0.05}$						
M	4.89	0.75	8.95	16.58	0.07	0.08
Y	1.59	0.24	2.90	5.38	0.02	0.02
M × Y	NS	NS	NS	NS	NS	NS

*Figures in the parenthesis are square root transformed

Table 3: Effect of different treatmentmodules onspeed of germination,seedling length (cm),seedling fresh weight (g), seedling dry weight (mg), vigour index-I (length) and vigour index-II (mass) in African marigold

Modules	Speed of germination	Seedling length (cm)	Seedling fresh weight (g)	Seedling dry weight (mg)	Vigour index-I (length)	Vigour index-II (mass)
M_1	23.21	10.68	0.37	6.97	808.19	527.34
M_2	24.17	10.69	0.38	7.03	821.55	540.11
M_3	24.73	10.79	0.40	6.86	836.35	531.89
M_4	25.87	11.12	0.43	6.84	874.43	538.10
M_5	25.05	10.92	0.42	6.96	855.64	545.31
M_6	26.46	11.21	0.40	7.16	884.55	564.73
M_7	26.50	11.26	0.41	7.29	882.86	571.75
M_8	28.33	11.61	0.45	7.31	929.62	584.40
M_9	27.35	11.31	0.42	7.17	900.99	570.88
M_{10}	29.48	11.69	0.45	7.38	930.15	587.08
M_{11}	29.01	11.76	0.49	7.48	947.61	602.61
M_{12}	30.12	12.15	0.50	7.62	1018.36	638.45
M_{13}	29.13	11.84	0.49	7.60	958.01	614.40
M_{14}	29.87	11.96	0.50	7.62	975.31	621.22
M_{15}	30.24	12.07	0.50	7.64	993.60	628.83
M_{16}	33.36	12.29	0.53	7.71	1031.71	647.64
M_{17}	31.94	11.84	0.52	7.68	986.86	640.93
M_{18}	32.48	12.66	0.55	7.78	1077.68	662.55
M_{19}	19.63	9.72	0.34	6.53	726.07	488.15
$CD_{0.05}$						
M	1.33	0.99	0.06	0.50	83.90	44.58
Y	0.36	0.32	0.02	0.16	27.22	14.47
M × Y	NS	NS	NS	NS	NS	NS