

# Influence of row spacing on yield and quality of common chamomile [*Chamomilla recutita* (L.) *Rausch.*] flower heads

AGNIESZKA SURMACZ-MAGDZIAK\*, JANUSZ WIŚNIEWSKI

Department of Industrial and Medicinal Plants,  
Agricultural University

ul. Akademicka 15, 20-950 Lublin, Poland,

\*corresponding author: phone: +48 81 4456884, e-mail: asm@ar.lublin.pl

## Summary

The experiment consisted of three single row spacings (every 25, 40 and 50 cm) as well as four cultivations in belt-type double and triple rows arrangement (40-25-40 cm, 40-25-25-40 cm, 50-25-50 cm, 50-25-25-50 cm). The highest flower head yield was achieved from triple spacing, the lowest – from single spacing every 25 cm. Essential oils content was higher in flower heads from belt and flavonoids from single spacing every 50 cm arrangement. The lowest levels of both essential oils and flavonoids were recorded in raw material from single every 20 cm spacing.

*Key words: Chamomilla recutita, chamomile, row spacing, flavonoids, essential oils*

## INTRODUCTION

Common chamomile (*Chamomilla recutita* (L.) *Rausch.*) is the oldest and most common medicinal plant. Its primary used as a sedative, anxiolytic, antispasmodic and antibacterial. Chamomile's main active constituents are essential oil and flavonoids. Flower heads collected at full blooming stage are herbal materials. Due to their both medicinal and industrial importance, chamomile is mass-produced in many countries, including Poland [1].

Its great medical traits and needs for chamomile materials invoked the studies upon the modification of up-to-date agrotechnology, which may positively affect the yielding and raw material quality.

## MATERIAL AND METHODS

The field experiment was carried out in 2001-2003 in Ostrów Lubelski on sand-loamy soil characterized by high content of available phosphorus and potassium as well as neutral pH. White mustard cultivated for green forage was chamomile's forecrop. Uniform mineral fertilization was applied every year ( $\text{kg}\cdot\text{ha}^{-1}$ ): N - 50, P - 26 and K - 67. The experiment was set by means of complete randomization in four replications according to following spacing: single rows every 40 cm (control), single rows every 50 cm, single rows every 25 cm, double rows every 25 cm by turns with 40 cm spacing (40-25-40), triple rows every 25 cm by turns with 40 cm spacing (40-25-25-40), double rows every 25 cm by turns with 50 cm spacing (50-25-50), and triple rows every 25 cm by turns with 50 cm spacing (50-25-25-50). Seeds of Złoty Łan cv. ( $2.5 \text{ kg}\cdot\text{ha}^{-1}$ ) were sown in the middle of April onto the  $27.5 \text{ m}^2$  area plots. Before the flower head harvest, the number of branches ending with flower heads or buds as well as the number of flower heads and buds were counted on 10 randomly selected plants of every plot. Every year, the first harvest of flower heads was made in about 5 days after blooming beginning, following two ones in 3-5 days after the previous ones. The yield of air-dried weight of flower heads was estimated after previous drying the material at  $35^\circ\text{C}$ . The content of essential oils (method of steam distillation using the Deryng apparatus) and flavonoids (the Christ-Müller method) were determined in an average sample consisting of flower heads from three following harvests. The results were statistically worked out using Tukey's test at 5% error level.

## RESULTS AND DISCUSSION

There are few agrotechnological literature references on common chamomile cultivation applying belt spacing. Instead, 40 cm spaces between plant rows are recommended [1, 2].

Spacing applied in present experiment significantly influenced chamomile traits. Plants growing in the triple belt spacing were characterized by the highest number of branches ending with flower heads and buds. Their lowest number was produced by plants grown at the single spacing every 25 cm (Table 1). The achieved results are consistent with those of Gruszczyk [3], who found that St. John's wort cultivation in belt spacing positively affected the number of branches. Among the compared spacing types, plants growing at triple belt one bloomed the most abundantly and produced larger number of flower heads as compared to control spacing (7.9 and 6.7, respectively). The plants from double belt cultivations were characterized by lower flower head number than from triple spacing, but both quantities were higher in relation to control (by 3.2 and 4.8, respectively, see Table 1). Similarly as in the case of flower heads, the largest number of buds was found at the plants from triple belt spacing and they produced, by 2.8 and 2.5 respectively, more buds as compared to the control. The plants grown at single spacing every 25 cm had the lowest numbers of flower heads and buds (Table 1).

Table 1.

Influence of row spacing on some traits of common chamomile (mean values from 2001–2003).

row spacing (cm)	number of branches ended with flower heads	number of flower heads	number of branches ended with buds	number of buds
40	10.1	14.3	1.9	3.8
50	10.5	15.0	2.3	3.8
25	8.6	10.5	1.7	3.3
40-25-40	11.8	17.5	2.5	5.2
40-25-25-40	13.5	21.0	2.7	6.3
50-25-50	12.4	19.1	2.5	5.7
50-25-25-50	14.1	22.2	2.6	6.6
mean	11.6	17.1	2.3	5.0
LSD <sub>0.05</sub>	1.23	1.64	0.49	1.09

Belt-shape row arrangement significantly influenced the yield of chamomile's flower heads. Higher yields resulted from more branches, flower heads and buds having been produced by plants from belt spacing. Among applied row arrangement types, the highest flower head yield was achieved from triple belt spacing (by 32% and 26.4% as compared to control, respectively, see Table 2). Such results were confirmed by other authors [3-5], who found that St. John's wort, fenugreek and dandelion cultivation in belt-type arrangement gave higher raw material yields than in single spacing.

Table 2.

Yield of air-dried flower heads (t/ha<sup>-1</sup>) and active substance content (%) in raw material (mean values from 2001-2003).

row spacing (cm)	yield of air-dried flower heads	essential oil content	flavonoids content
40	1.25	0.78	4.5
50	1.28	0.80	4.7
25	0.99	0.69	3.9
40-25-40	1.47	0.87	4.1
40-25-25-40	1.58	0.83	4.1
50-25-50	1.50	0.86	4.3
50-25-25-50	1.65	0.85	4.2
mean	1.39	0.81	4.3
LSD <sub>0.05</sub>	0.08	-	-

Załęcki [2] and Salamon [6] did not find the influence of single chamomile rows on essential oil contents in raw material. In our experiment, plant material from belt spacing cultivation was characterized by higher level of studied substances. Within the belt arrangement, flower heads from double rows were distinguished by higher contents of essential oils (Table 2). Our results were confirmed by Kołodziej and Zejdan [4] as well as Sugier [5], who found that fenugreek seeds and

dandelion roots collected from belt-type cultivation were characterized by higher amounts of biologically active substances.

Flavonoid contents in flower heads ranged from 3.9% to 4.7%, which was consistent with other author's results [7]. Among the compared row arrangements, the lowest level of flavonoids was recorded at the flower heads from single rows every 25 cm, the highest – single spacing every 50 cm. The flower heads of the plants cultivated in belt spacing were characterized by lower levels of the compounds (by 0.3%, on average) as compared to control object (Table 2).

## CONCLUSIONS

1. Belt-type row arrangement more positively affected the production of higher number of branches, flower heads and buds on a plant.
2. Yield of chamomile flower heads was the highest from triple spacing, the lowest - from single spacing every 25 cm.
3. Essential oil content was higher in the flower heads of the plants cultivated in belt spacing, flavonoids – in single spacing every 50 cm. The lowest contents of essential oils were found in raw material from single spacing every 25 cm.
4. It is recommended to cultivate chamomile in triple or double belt-type arrangements.

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## WPŁYW ROZSTAWY RZĘDÓW NA PŁONY I JAKOŚĆ KOSZYCZKÓW RUMIANKU POSPOLITEGO [*CHAMOMILLA RECUTITA* (L.) *RAUSCH.*].

AGNIESZKA SURMACZ-MAGDZIAK\*, JANUSZ WIŚNIEWSKI

Katedra Roślin Przemysłowych i Leczniczych,  
Akademia Rolnicza,  
ul. Akademicka 15, 20-950 Lublin

\*autor, do którego należy kierować korespondencję:  
tel.: +48 81 4456884, e-mail: asm@ar.lublin.pl

### Streszczenie

W doświadczeniu polowym zastosowano trzy rozstawy rzędów rozmieszczonych pojedynczo (co 25, 40, 50 cm) oraz cztery rozstawy w pasowym układzie rzędów podwójnych i potrójnych (40-25-40 cm, 40-25-25-40 cm, 50-25-50 cm, 50-25-25-50 cm). Najwyższy plon koszyczków otrzymano z rozstaw pasowych potrójnych, zaś najniższy z rozstawy pojedynczej co 25 cm. Zawartość olejku była większa w koszyczkach z rozstaw pasowych, zaś flawonoidów z rozstawy pojedynczej co 50 cm. Najmniejszą ilość tak olejku, jak i flawonoidów stwierdzono w surowcu z rozstawy pojedynczej co 25 cm.

*Słowa kluczowe: rumianek pospolity, rozstawa rzędów, Chamomilla recutita, flawonoidy, olejek*