

Study on the water use of Chicory in Beijing of China

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Introduction Chicory (*Cichorium intybus* L.), a succulent forage needed for the developing cow industry (Dong, 2001), was introduced to Beijing. However, the deficient water resource is a key limiting factor for sustainable development of forage in Beijing. Water use of chicory needs to be studied further before it can be fully utilized in Beijing.

Materials and methods The experimental site, with a mean temperature of 12.2 °C and average annual precipitation of 518.3 mm, was located in Shunyi County in the northeast of Beijing. Chicory was planted in spring with a seeding rate of 12 kg/hm². The plot area with 3 replications was 5m 10m each, and the space between plots was 2 m. Buffer areas were covered by plastic film to prevent water infiltration. Three different irrigation treatments of 60 mm (CK, 600 m³/hm²), 40 mm (MS), and 20 mm (SS) were applied for regrowth after 4 and 5 mowing were applied in 2002 and in 2003, respectively. The yield of chicory and the soil water content of each 10 cm (0~160 cm) were determined. Water content was determined using a 503DR9 Neutron Probe (CPN Co., Ltd., USA) every 15 d. The water use of crops (ET_c) is calculated by the equation: ET_c=I + P + ΔW; where P is the precipitation; I is the amount of irrigation; ΔW is the change of water shortage in the solum; all units are in mm (Yang and Shi, 1997). The water use efficiency is calculated by equation: WUE=Y/ET, where Y is the economic yield (Shan, 1994).

Results The irrigation of 20 mm produced a yield of 19039kg DM/hm² in 2002 and 22278.9kg DM/hm² in 2003, and 60 mm produced a yield of 22508.9 kg DM/hm² in 2002 and 27552 kg DM/hm² in 2003. The results indicated a yield of 56.7~143.8 kg/hm² could be gained with a daily water consumption of 1.88~3.61 mm. A strong positive relationship existed between water use and irrigation over the entire growing period (R²=0.9689). The average water use at the second and third-harvests was 25.0%~29.8% more than that of the other harvests. A quadratic relationship existed between water use and yield for the entire growing period. Total water use ranged from 506.7 to 584.2 mm and the WUE from 37.6 to 39.1 kg/hm²·mm in 2002, and 517.9 to 643.8 mm and 42.8 to 45.9 kg/hm²·mm in 2003, respectively. In addition, WUE increased with an increase in harvest times, and the WUE was the highest with 39.1 kg/hm²·mm in 2002 and 45.9 kg/hm²·mm in 2003 with the MS treatment (Table 1). The results suggested that irrigation is required for growing chicory in Beijing.

Table 1 The water utilization efficiency of chicory (kg/hm²·mm).

Years	Treatments	First-harvest	Second-harvest	Third-harvest	Fourth-harvest	Fifth-harvest	Total
2002	CK	33.56	37.91	38.63	44.4	-	38.53
	MS	32.15	38.84	41.24	44.34	-	39.12
	SS	30.22	35.15	40.02	45.04	-	37.57
2003	CK	37.32	41.41	42.48	48.94	45.97	42.80
	MS	37.83	45.57	47.43	51.13	49.32	45.86
	SS	36.24	42.57	43.86	48.04	46.66	43.02

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