accumulation due to reduced leaching. In peach studies, saline water under deficit irrigation increased soil salinity along the drip line, but rainfall and sandy soils helped stabilize salinity at the end of the season (Toumi et al., 2024). Similar processes may limit long-term deficit irrigation in pear orchards, requiring monitoring of soil electrical conductivity and periodic leaching.

Table 1 Yield, fruit quality, and shoot length of each treatment (Adopted from Wu et al., 2021)

Year	Treatment	Yield (t/ha)	Total Soluble Solid Content (%)	Soluble Sugar Content (%)	Fruit Volume (cm3)	Final Shoot Length (cm)	Shoot Length in Late May (cm)
2009	MRDI-1	18.9 ab	12.3 b	8.14 c	94 a	27.5 b	25.6 b
	SRDI-1	21.5 a	12.5 ab	8.82 a	100 a	25.9 bc	23.6 bc
	MRDI-1+2	18.1 bc	12.0 bc	7.97 c	103 a	26.0 b	24.9 bc
	SRDI-1+2	15.8 c	13.1 a	8.61 b	96 a	24.0 c	22.3 c
	Control	18.6 b	11.5 c	6.93 d	98 a	32.4 a	30.2 a
2010	MRDI-1	21.2 ab	12.8 b	8.08 a	116 a	25.4 b	23.1 b
	SRDI-1	23.6 a	13.8 a	8.05 a	123 a	23.9 c	21.9 b
	MRDI-1+2	20.6 b	13.6 a	7.71 bc	113 a	24.3 bc	22.6 b
	SRDI-1+2	17.2 c	13.9 a	7.99 ab	122 a	22.5 c	21.0 b
	Control	19.8 b	13.6 a	7.63 c	114 a	31.3 a	29.1 a

Note: Different letters within the same column indicate significant differences at the $p < 0.05$ level. MRDI-1 and SRDI-1 were applied with moderate and severe water stress, respectively, during Stage 1 (0~30 DAB), and fully irrigated during other stages; MRDI-1+2 and SRDI-1+2 were applied with moderate and severe water stress, respectively, during Stage 1+2 (0-86 DAB), and fully irrigated during other stages. The shoot lengths in late May were measured on 20 and 21 May in 2009 and 2010, respectively; the final shoot lengths were measured on 4 September and 29 August in 2009 and 2010, respectively (Adopted from Wu et al., 2021)

In the Bukhara region of Uzbekistan, dwarf high-density orchards of "Williams," "Abbot," and "Carmen" under drip irrigation reduced water use by half while increasing yield per tree to 1.6 kg. This shows that proper planting density and canopy management can help reduce climate and soil limitations (Yunusov et al., 2023). In the Dukagjini Plain of Kosovo, irrigation at 100% and 50% ETc resulted in yields of 8.33 kg and 5.10 kg per tree, respectively, but the 50% ETc treatment produced a higher proportion of high-quality fruits. This indicates that climate-soil-water interactions significantly affect both yield and fruit grading (Lepaja et al., 2024).

6.3 Adaptability of moderate deficit irrigation in different regions

Evidence from pear experiments and global meta-analyses of woody fruit trees shows that moderate deficit irrigation has wide adaptability, but optimal thresholds and strategies vary by region and cultivar. For woody fruit trees (including pear), mild deficit irrigation at 80%~100% irrigation level can slightly increase yield (+0.87%) and improve water productivity (+9.77%). Stronger seasonal deficits may reduce yield by about 14%, but still improve water productivity. Deficit irrigation is suitable for regions with annual precipitation over 400 mm and mean annual temperature ≥10 °C, and should be applied mainly during early growth stages to reduce yield risk (Wen et al., 2023).

In high-rainfall or high-altitude tropical regions (such as Sesquilé, Colombia), RDI can be applied at relatively high intensity (even down to 27% ETc or with no irrigation during certain stages) without affecting yield and quality of "Triunfo de Viena." This is because rainfall and deep soils buffer water fluctuations, and the main advantage is significant water saving.

In arid and semi-arid inland regions (such as Xinjiang in China, semi-arid Brazil, and northern desert regions of China), deficit irrigation needs to be more conservative and combined with efficient irrigation methods. In fragrant pear production, subsurface drip irrigation at 30 cm depth combined with a higher irrigation amount (6 750 m^3/ha) can optimize yield, quality, water use efficiency, and economic returns. Subsurface drip irrigation can increase yield by 13%~17% and water productivity by 45%-137%, showing that improving irrigation methods can sometimes be more effective than simply reducing water amount. In semi-arid Brazil, optimal yield is close to full irrigation level (about 92% ETc), indicating limited room for deficit irrigation under high evaporation and shallow soil conditions (Gomes et al., 2023).