

Vertical parameters of the zone of aeration

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Abstract: Vertical parameters of the above-aqifer zone for the area of Čačak necessary to gain insight in the local agriculture development, have been analysed. The results have shown that the annual precipitation amounts exceeded those of potential evapotranspiration. However, this wasn't the case during the vegetation period when the needs for water were the highest. During the vegetation, water deficit of 125,3 mm was recorded.

Key words: above-aquifer zone parameters, the annual precipitation, potential evapotranspiration, water deficit.

Introduction

As the part of plant production, soil irrigation is considered to be significant both, technically-technologically and agronomically-biologically within the local growth of agriculture.

One should closely be familiar with the particular conditions in order to appropriately use irrigation no matter how deficient precipitations may be. Among others, the environmental, soil and water conditions necessary for plant growth are considered to be the prior ones.

The environmental conditions are known to bring about the natural water afflux in the soil as well as about the extent of evapotranspiration and the need for irrigation, too. Of the environmental factors, precipitations, which should provide a constant water supply to help normal plant growth and development, are considered to be the most significant ones.

Water amount needed for plant growth has been found to fit the values of the potential evapotranspiration. Therefore, its values and precipitation amounts represent the basis of establishing the balance of the aeration zone (vertical

parameters of the balance concerned), i.e. the deficits and surpluses of water and the real evapotranspiration, as well.

With the aim of gaining a better insight and a benefits of the local agricultural development, the parameters determined for the area of Cacak, have been defined.

Method and materials

Vertical parameters of the aeration zone balance(1949-1999) were determined following the method of Thornthwait (Vucic, 1976). The values of the potential evapotranspiration determined by this method had been found to have been at the level of the monthly values, on the basis of which the mean monthly ones were obtained over the 51-year long period.

Throughout the water balance calculations, the soil was presumed to contain 100 mm water reserve in its rhizosphere zone and, as such, assessed as fully waterlogged.

Evapotranspiration seemed to be fairly steady until around 100 mm water reserve had been utilised, with the rest of rainfall amounts having flown off as a water surplus. Should no water is contained in the water, evapotranspiration will have become equal to zero by the occurrence of rainfalls.

Results and discussion

The results of analysing the aeration zone's vertical parameters obtained over the 51-year long period (1949-1999) indicated that June had been the rainiest month (89.4mm), succeeded by somewhat lower rainfall amounts in May (82.4mm) and those in July (75.9mm), with the potential evapotranspiration (ETP) found to be the highest in July (130.7mm), then lower in August (118,7mm) and the lowest in June (117.9mm), Fig.1.

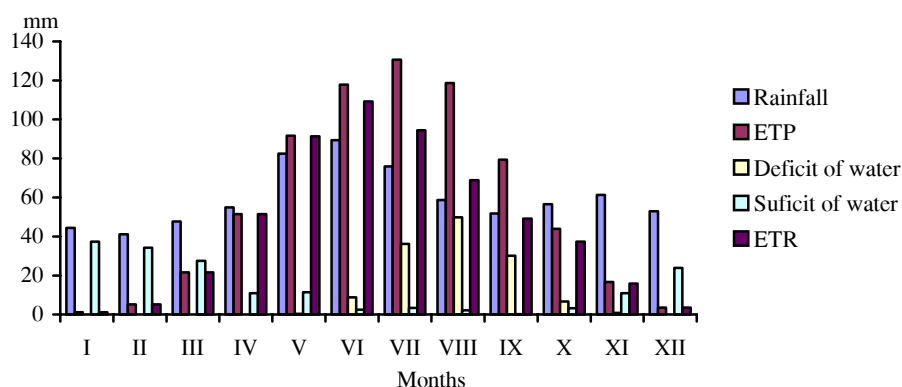


Fig. 1. The mean monthly of vertical parameters of above-aquifer zone for the area of Čacak (1949-1999)

Water deficits monitored from May to November pointed at the most expressed ones in August (49.9mm), July (36.2mm) and in September (30.1mm), Fig.1, with the rest of months showing no significant water deficit values (0,3-8,8mm), Fig.1.

Water balance suggested appearing of the water surpluses all the year round with the insignificant values registered from June to October (0,2-3,5mm), more significant from November to May and the most significant ones manifested in January (37,3 mm) and in February (34,3 mm), Fig.1.

Considering that water amounts are mainly limited under natural conditions, the plants will not satisfy their needs with the required amounts but may only utilise the available ones. So utilised water may be regarded as the actual or real evapotranspiration (ETR).

The real (actual) evapotranspiration, as well as the potential one, had the highest values over the summer time, being the most pronounced in June (109.1mm), July (94,5mm) and in June (91,3mm). Fig.1. ETR value may be equal to the ETP value unless the soil water deficits take place or possibly less than the ETP one.

The balance of the vertical parameters of the aeration zone over the 51-year long period made it possible not only for the mean monthly but also for their annual values to be evidenced. These calculations may be confirmed by checking the mean values of the annual balance when $ETP = ETR + M$ and $P = ETR + V$ (Vlahinjac, 1982).

The results of current investigations are, as follows:

- The mean annual precipitation amount for Čačak established to be 717.4mm, followed by the potential evapotranspiration real (ETP) of 681,9 mm, water deficits (D) of 132.7 mm, its surpluses (S) of 168,2 mm and relative evapotranspiration (ETR) of 549,2 mm (Fig.2.).

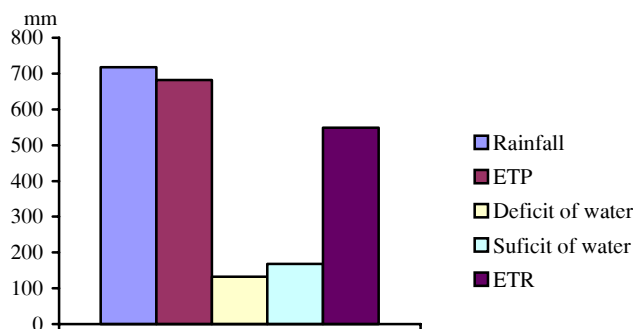


Fig. 2. The mean annual values of vertical parameters of the above-aquifer zone for the area of Čačak (1949-1999)

- The soil water deficits of the area concerned proved to be the most pronounced over the vegetation period when the plants needed water

most. This resulted from the high values of the evapotranspiration (ETP) during that period due to high air temperatures.

- The precipitation amounts monitored over the vegetation for the area of Cacak accounted for 413,2mm, the ETP values 589,7mm, water deficits 125,3 mm, its surpluses 30.8mm and/or ETR 464,4mm (Fig.3.).

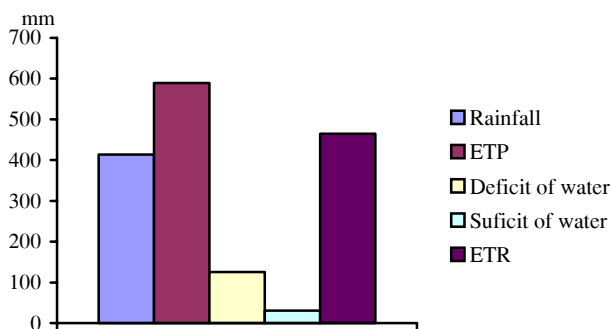


Fig. 3. The average sum of the vertical parameters of the above-aquifer zone for the area of Čačak recorded over the vegetation period (1949-1999)

Interestingly, when compared with the values of the vertical parameters of the aeration zone of Novi Sad, the values of the water balance of the area of Cacak also proved June to be the rainiest month (86mm), with the highest ETP as well as in July (138 mm), with the most expressed water deficit in August (61 mm), the highest water surplus in February (30 mm), with the actual evapotranspiration being even to that of Cacak with its highest value manifested in June (125mm) (Dragovic, 2000).

Conclusion

In addition to others, the analysed vertical parameters of the aeration zone for the area of Cacak are considered to be unavoidable for considerations of the issues of the local agricultural development. The analysis results indicated that the annual rainfall amounts had exceeded the values of the potential evapotranspiration. However, rainfall values were reported to be the lowest and even deficient (125.3mm) throughout the vegetation period just when the plant needs for water were the highest.

References

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VERTIKALNI PARAMETRI BILANSA NADIZDANSKE ZONE

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Rezime

Prikazani su rezultati i analiza bilansa nadizdanske zone zemljišta za područje Čačka tokom dugogodišnjeg niza (1949-1999). Rezultati analize ukazuju da se manjkovi vode zemljišta manifestuju od maja do novembra. Najveći nedostatak vode je u avgustu i julu. Viškovi vode zemljišta se pojavljuju tokom cele godine, s' napomenom da su zanemarljive vrednosti u periodu jun-oktobar, dok su značajnije vrednosti suficita vode tokom perioda novembar-maj. Najveći višak vode zemljišta manifestuje se u januaru i februaru.