The Collection Effect Of Trees On Fog Water

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INTRODUCION

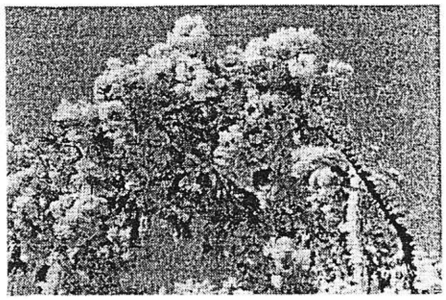
Many people hold the view that precipitation from the sky is the only water resource in alpine regions. Whenever a drought attacks somewhere,most people only think of using well water and brook water . In reality ,there is another water resource having not provoked much attention ,i.e.,fogs and clouds in the sky . when it is foggy but does not rain , a wet area will appear right under a tree ,which is because the tree collects fog water.It is a non-negligible water resource that can play a certain role in promoting the growth of trees and the improvement of the ecological environment.How to collect and make use of cloud and fog water is a new rewarding research subject.

1.Precipitation Resulted From Fogs In Alpine Region

The observation indicates the precipitarion rate can be up to 1.75mm/hr,1.7mm/hr averagely.It is estimated that the annual amount is about 200-300mm,nearly accounting for 1/6 of the annual totol rainfall.The paper also introduces Microphysical Chaaracteristics of fogs and effect of tree spcies and chemical composition content of precipitation resulted from fogs.

There are 192 foggy days in one year ,on an average ,in Gulin of Lushan Mountain,
Which has a sea level elevation of 1100m .In foggy days ,the relative humidity is usually greater than 95%. One's hair will be full of water droplets while walking in the fogs and there will be water droplets falling to the ground under trees, thus make the surface covered by trees wet.On Lushan Mountain, mean annual precipitation is 1800mm,mot including precipitation resulted from fogs under trees.

In fact,fog droplets would collide the leave and branches of trees thus resulting in precipitation, whose amount cannot be overlooked. In water,a large amount of rime on the leaves and branches of trees would melt into water, the amount of which is considerably large.The observation indicates that the precipitation rate can be up to 1.75mm/hr , 0.7mm/hr averagely . It is estimated that the annual amount is about 200-300mm , nearly accounting for 1/6 of the annual total rainfall. Although the precipitation is only limited to the areas right under trees and cannot from surface runoff, it plays a certain role in promoting the growth of trees and improving the ecological environment. Figure 1 is the schematic diagram of a fog resulting in precipitation under trees. The observation also shows that the amount of precipitation from a fog is dependent on the sizes of tree branches and the heights of tree crowns. Needless to say, the gigher a tree is the larger the precipitation is.



Fig,1.The schematic diagram of a fogs resulting in precipitation under trees.

2.Microphysical Characteristics of Fogs and Effect of Tree Species

The formation of precipitation resulted from fogs is dependent on the microphysical Chatacteristics of clouds and fogs as well as the species of the trees. Fogs can be divided into two categories: dry fog and wet fog. Their microphysical chatacteristics are shown in Table

Table 1. The Microphysical Chatacteristics of Dry and Wet Fogs

Type	Number of samples	Mean diameter (μm)	Peak diameter (μm)	RMS diameter (μm)	Cubic root diameter (μm)	Maximum diameter (μm)	Conc (cm^{-3})	Water Content (g/cm^3)	Visibility (m)	Wind speed (m/s)
Dry fog	18	7.2	5.2	8.1	9.1	23.4	758	0.28	40-100	0-4
Wet fog	25	10.0	5.8	11.3	13.6	35.1	758	1.1	30-50	0-4

Dry fogs have smaller droplets, smaller water content and narrower spectrum. While walking in the dry fogs, there would not be water droplets on hairs. It can be seen from Table 1 that the mean diameters of droplets is 7.2 μm for dry fogs and 10.0 μm for wet fogs; the maximum diameter is 23.4 μm for dry fogs and 35.1 μm for wet fogs; water content is 0.28g/m for dry fogs and 1.1g/m for wet fogs, the former being only 1/4 of the latter. It is observed that the maximum droplet concentration is up to 1243/cm and the maximum water content is up to 2.09g/m for wet fog and there will be water droplets falling under trees when water content of a fog reaches 0.5g/m under the calm condition.

The precipitation resulted from a fog is also related to the species of trees. Generally speaking, it is greater under coniferous trees compared to broadleaf trees. This is because fog droplets can collide more easily with the leaves of conifers, while the air is likely to flow around the broadleaf.

There is big difference in spectrum pattern between dry and wet fogs (see Fig.2). It can be seen from the following figure that there are differences mainly in the width of spectrum and the number of large drops.

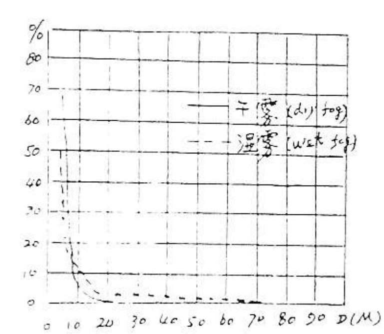


Fig.2. The specrtrum patterns of dry and wet fogs.

3.Chemical Composition Content of precipitation Resulted from Fogs

Cloud and fog contain various kinds of chemical substances, whose contents vary with time and location. The chemical substances both in rain water and in precipitation resulted from fogs on

Lushan Mountain are listed in Table 2.

Table 2. Comparison of Chemical Substances in Water between Normal Rain and Precipitation Resulted from a Fog (at the same altitude)(μ eq/L)

	PH	F^-	Cl^-	No_3^-	So_4^{--}	NH_4^+	K^+	Na^+	Ca^+	Mg^{++}
Water from fogs (WFF)1989(date)	5.36	5.76	14.23	33.82	158.96	40.54	9.3	17.77	199.61	18.15
Water from fogs 1993(date)	4.23	17.0	40.6	128.0	411.0	179.0			156.3	27.2
Rain water (RW)	5.13	0.53	14.45	4.51	28.03	13.34	2.75	7.29	28.46	0.95
WFF/RW		10.9	0.98	7.5	5.67	3.49	3.38	2.44	7.01	19.11

It can be seen that on Lushan Mountain, Cl in water from fog (WFF) is close to that of rain water (RW); the other ions in WFF are more than in RW; and pH in WFF is also greater than in RW. It indicates that chemical substances differ between them. In water from fogs, So_4^{--} and No_3^- content accounts for more than 90% in negative ions.

Table 3 shows chemical substance content both in water from a fog on Lushan Mountain and in rain water at the mountain foot.

Table 3 Chemical Substance Content in WFF on Lushan Mountain and in RW at the Mountain Foot(μ eq/L)

	PH	F^-	Cl^-	No_3^-	So_4^{--}	NH_4^+	K^+	Na^+	Ca^+	Mg^{++}
Water from fogs (WFF)	5.26	2.57	8.46	21.69	110.88	74.51	11.46	4.23	60.95	6.47
Rain water (RW)	4.96	1.05	14.29	11.11	42.89	61.51	34.11	7.86	21.56	2.47
WFF/RW		2.45	0.59	1.95	2.59	1.21	0.34	0.54	2.83	2.73

It can be seen from Tables 2 and 3 that the ratios of WFF/RW decrease after natural raindrops descend about 1100m to the mountain foot.

No research has been reported so far that natural precipitation resulted from fogs has ever been utilized. In order to make better use of the water resource from fogs, some practical work could be done such as setting fog collecting screen, plating more tree, etc. It is of great economical significance for the mountainous regions attacked frequently with droughts and fogs.

Lushan fog of 35 years change

Date	Temperature (°C)	Visibility (meter)	Water content (g/m^3)	Mean diamter (μ m)	Peak diamter (μ m)	Maximum diamter (μ m)	Concentration (cm^{-3})	Number of samples
April.1998	0.17	84.7	0.32	10.6	4.6	46.6	209.8	15
1963-1964	4-13	67.3	0.38	14.5	6.7	55.2	476.2	103

4. References

Ding Guoan and Yu Xiangren (1991), The Characteristics of Cloud and Fog Water Chemical Composition on Lushan Mountain, Acta Meteorologica Sinica.

Yu Xiangren, The Observational Study of Dry and Wet Fogs.