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Heat And Radiation Conditions of Flat and Inclined Lands

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Abstract. Earlier to sowing seeds of rural crops, mindfulness of the warm, water, and light administrations of the arrive is of extraordinary significance. In this article, we examined the warm and temperature conditions of level and slanted lands through the warm exchange conditions within the soil. At the same time, the temperature invariance at a certain profundity from the soil surface was primarily gotten, on the premise of which an equation for calculating the soil temperature from the dregs was inferred by the strategy of consonant investigation. In expansion, equations for level Arrive and temperature administrations of 10˚, 20˚, 30˚ inclines relative to the skyline for southern and northern surfaces have been discharged. Hypothetical calculations have appeared that the temperature on the inclines is higher than on the level lands compared to the test comes about. This recommends that rural specialists are making conditions for sowing plant seeds within the ground in early spring.
Keywords: sun based radiation, sun based radiation retained within the soil, warm conductivity coefficient, warm flux, precise speed, temperature, warm exchange coefficient, sun oriented radiation retention coefficient, geological scope, point of slant, hour point of the sun, point of avoidance of the sun, soil temperature, sun based radiation falling vertically on the earth's surface.

Introduction

These days, ask approximately pointed at expanding the utilize of non-traditional and renewable imperativeness sources and keeping up the organic alter of the environment is getting to be basic inside the world essentialness sharpen. In this regard, in made countries, long-term programs set the objective to expand the utilize of renewable essentialness sources to at smallest 20%. At the same time, the foremost center is on the utilize of sun fueled essentialness in cultivation for warm and control supply. A third of the world's essentialness utilization is utilized for horticulture [1].

The object of the study and the methods used

In this article, when considering the warm and temperature conditions of the fields and inclines of arrive, utilizing the strategy of consonant investigation of the warm dissemination within the soil, the alter in soil temperature at a given profundity was gotten as unaltered and the warm conductivity conditions for level arrive and for lands with diverse slants were determined. The hypothetical calculation is compared with the comes about of the try, conclusions are drawn and proposals are made.

Obtained results and their analysis

Within the winter and spring months, the sun is at a slight point with regard to the plain, due to which the sum of sun powered radiation falling on the slants in comparison with the plain gets to be huge. This proposes that an incline compared to flat Ground shows a better Ground temperature. To solve the issue, the conditions of warm dispersion within the soil are utilized, since these conditions have the taking after shape: [2,3].

$$a\frac{\partial^2 t(x,\tau)}{\partial x^2} = \frac{\partial t_S(x,\tau)}{\partial \tau} \qquad (1)$$

$$Q_{ab}(\tau) + \lambda\frac{\partial t_S(x,\tau)}{\partial x} - \alpha_{con}[t_S(\tau) - t_{a.t}(\tau)] = 0 \qquad (2)$$

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Here:

Q_{ab} – solar radiation absorbed by soil surface;
t_S – temperature of soil surface;
$t_{a.t}$ – surface level air temperature;
a – thermal conductivity coefficient;
x – coordinate in the direction of heat flow;
α_{con} – coefficient of thermal conductivity of soil;
λ – presented heat transfer coefficient of soil surface;
τ – time.

(1) as the limiting condition of the formula, the change in the temperature of the soil surface in depth is taken

$$t_S(\tau)/_{x \to \infty} = const \qquad (3)$$

The solution of the heat equation, taking into account the boundary condition in Formula (3), is as follows:

$$t_S(x,\tau) = t_{S_0} + e^{-x\sqrt{\frac{\omega}{2a}}}\left[t_S cos\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right) + t_{S_2}\sin\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right)\right] \qquad (4)$$

Here:

t_{S_0} – average annual soil surface temperature;
ω – angular velocity of the Earth's rotation around the Sun;
t_{S_1}, t_{S_2} – coefficients;
e – base of the natural logarithm

For the case of flat surface of soil ($x = 0$), solution (4) has the form:

$t_S = t_{S_0} + t_{S_1}\cos(\omega\tau) + t_{S_2}\sin(\omega\tau)$ (5)

By using the method of harmonic analysis of t_{S_1}, t_{S_2} coefficients of the average annual temperature of solar radiation absorbed by the earth, when taking into account the temperature in the layers, the following formulas arise:

$$\begin{cases} Q_{ab} - \alpha_{con} \cdot t_{S_0} + \alpha_{con} \cdot t_{a.t} = 0 \\ Q_{ab_1} - \lambda\sqrt{\frac{\omega}{2a}}\left(t_{S_1} + t_{S_2}\right) - \alpha_{con} \cdot t_{S_1} + \alpha_{con} \cdot t_{a.t} = 0 \\ Q_{ab_2} + \lambda\sqrt{\frac{\omega}{2a}}\left(t_{S_1} - t_{S_2}\right) - \alpha_{con} \cdot t_{S_2} + \alpha_{con} \cdot t_{a.t} = 0 \end{cases} \qquad (6)$$

Solving the formula (6), we find t_{S_0}, t_{S_1} and t_{S_2}:

$$t_{S_0} = \frac{Q_{ab}}{\alpha_{con}} + t_{a.t} \qquad (7)$$

$$t_{S_1} = \frac{\lambda\sqrt{\frac{\omega}{2a}}(Q_{ab_1}+Q_{ab_2})+\alpha_{con}Q_{sb_1}+\alpha_{con}\lambda\sqrt{\frac{\omega}{2a}}(t_{a.t_1}+t_{a.t_2})+\alpha^2{}_{con}t_{a.t_1}}{\lambda^2\frac{\omega}{a}+2\alpha_{con}\lambda\sqrt{\frac{\omega}{2a}}+\alpha^2{}_{con}} \qquad (8)$$

$$t_{S_2} = \frac{\lambda\sqrt{\frac{\omega}{2a}}(Q_{ab_1}+Q_{ab_2})+\alpha_{con}Q_{ab_2}+\alpha_{ab}\lambda\sqrt{\frac{\omega}{2a}}(t_{a.t_1}+t_{a.t_2})+\alpha^2{}_{con}t_{a.t_2}}{\lambda^2\frac{\omega}{a}+2\alpha_{con}\lambda\sqrt{\frac{\omega}{2a}}+\alpha^2{}_{con}} \qquad (9)$$

The yearly changes within the temperature of the surface layer of discuss and the retained sun based radiation with a soil radiation retention coefficient of 0.7, for the conditions of Gulistan, have the taking after frame:

$$t_{a.t} = 13.3 + 11.4\cos(\omega\tau) + 7.4\sin(\omega\tau) \qquad (10)$$

$$Q_{ab} = 119 + 53\cos(\omega\tau) + 15\sin(\omega\tau) \qquad (11)$$

If we put obtained values into formulas (7), (8), (9), at that time $t_{S_0} = 18.8$; $t_{S_1} = 12.9$; $t_{S_2} = 9.2$, on the basis of these values annual soil temperature (4) formula will be as follows:

$$t_S(x,\tau) = 18.8 + e^{-x\sqrt{\frac{\omega}{2a}}}\left[12.9\cos\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right) + 9.2\sin\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right)\right] \quad (12)$$

(12) for flat land, the formula can be used to calculate the temperature in different layers of the soil.

Using the above method (harmonic analysis method), calculate the temperature regime of the slopes. By the amount of annual solar radiation absorbed by the earth, by the outdoor air temperature, t_{S_1} and t_{S_2} coefficients are found:

$$t_{S_1} = \frac{\lambda\sqrt{\frac{\omega}{2a}}(Q_{ab.sl_1}+Q_{ab.sl_2})+\alpha_{con}Q_{ab.sl_1}+\alpha_{con}\lambda\sqrt{\frac{\omega}{2a}}(t_{a.t_1}+t_{a.t_2})+\alpha_{con}t_{a.t_1}}{\lambda^2\frac{\omega}{2a}+2\lambda\sqrt{\frac{\omega}{2a}}+\alpha^2{}_{con}} \quad (13)$$

$$t_{S_2} = \frac{\lambda\sqrt{\frac{\omega}{2a}}(Q_{ab.sl_1}+Q_{ab.sl_2})+\alpha_{con}Q_{ab.sl_1}+\alpha_{con}\lambda\sqrt{\frac{\omega}{2a}}(t_{a.t_1}+t_{a.t_2})+\alpha_{con}t_{a.t_2}}{\lambda^2\frac{\omega}{2a}+2\lambda\sqrt{\frac{\omega}{2a}}+\alpha^2{}_{con}} \quad (14)$$

To determine the solar radiation absorbed by the slope of the ridge, we use the well-known ratio borrowed from the work [3-5]:

$$Q_{ab.sl} = KQ_{\perp}cosi$$

or

$$Q_{ab.sl} = KQ_{\perp}(\sin(\varphi-\alpha)\,cos\delta + \cos(\varphi-\alpha)\,cos\delta cos\tau) \quad (15)$$

Here:

$Q_{ab.sl}$ – solar radiation absorbed by the slope of ridge;
K – coefficient of absorption of sunlight by slope surface;
$Q_{\perp}$ – solar radiation occurring on a surface perpendicular to sunrays;
i – angle of incidence of sunrays on the slope;
φ – latitude of the area;
α – slope angle;
τ – hour angle of the sun.

Taking into account $t_{a.t}$, $t_{a.t_1}$, and $t_{a.t_2}$ coefficients temperature equation of annual slope lands by depth will be as follows:

$$t_{a.t}(x,\tau) = 19.25 + e^{-x\sqrt{\frac{\omega}{2a}}}\left[13.5\cos\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right) + 10.1\sin\left(\omega\tau - x\sqrt{\frac{\omega}{2a}}\right)\right] \quad (16)$$

Based on the comes about of the calculation based on the equations found, the temperature conditions of the level and slanted territory on Walk 15 and April 15 will be at the level of 3.4-3.6°C higher than on the level territory, in expansion, the profundity temperature will be 2.5-3 ° C higher than on the level landscape. This proposes that when sowing crops, sowing crops on inclining zones gives tall productivity.

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