A NOTE ON THE APPRAISAL OF CAUSES OF MORTALITY OF SHISHAM AND MULBERRY SEEDLINGS IN THE NURSERY FROM THE PHYSICO-CHEMICAL ANALYSIS OF SOIL

by

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Samples of irrigation water and soil from the nursery beds were analysed for ascertaining the causes of high rate of mortality of Morus spp. and Dalbergia sissoo seedlings in Kalar Kahar Forest nursery, Jehlum Forest Division. The water had permissible limits of soluble salt content. The soil was, however, distinctly alkaline (pH 8.4 to 8.8). Presence of unusual high content of lime was suspected to be responsible for causing deficiency of P and other available nutrients.

Applications of ammonium sulphate and superphosphate are suggested to improve soil reactions and availability of common plant nutrients.

Mulberry (*Morus* spp). and Shisham (*Dalbergia sissoo*) plants are well acclimatized to the climatic and edaphic conditions generally prevailing in the plains of West Pakistan, where they normally exhibit vigorous growth and, comparatively, do not require much care after germination.

Jhelum Forest Division, as such, is situated in the northern reaches of plains of the Punjab. It, however, covers a large area of salt range. The natural forests are of scrub type, having *xerophytic* flora. The soil is mostly sandyloam. The physiography is undulating, interspersed with ridges and small hillocks. Water is somewhat saltish and generally scarce, but, where it is plentiful, the area is green and supports even fruit orchards. This fact points towards the general fertility of soil.

At Kalar Kahar, in Noorpur Forest Range, a nursery is being maintained by the Forest Department, on an elevated ground at the base of a hillock facing Kalar Kahar Lake, for raising common roadside trees like Bakain (Melia *azedarach*, Tut (*Morus.* spp), Shisham (*Dalbergia sissoo*) and local fruit trees like Lukat (*Eriobotrya Japonica Lindle*). and Lasura (*Cordia myxa*). It is irrigated through a small water-course which is supplied by a natural spring from a nearby hillock. The smell of sulphur is quite pronounced in the area from where the spring takes its origin.

At the time of visiting the nursery, during December, 1972, it was noticed that shisham and mulberry seedlings suffered from high rate of mortality. The local forest

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staff was keen to know the cause of malady. Other plants in the nursery were also not doing well. The problem was, therefore, taken in hand to assess the factors responsible for this failure.

MATERIAL AND METHODS.

Sample of spring water was collected at the source and the soil of shisham and mulberry nursery beds, having high rate of mortality, was sampled at 3″ and 27″ depths.

Presence of sulphur, in the irrigation water, was detected by the procedure prescribed by Furman (3). Sodium and potassium were estimated by Flame Photometry. Total salts were determined through estimation of specific conductivity. Phosphorus content of soil was estimated by colorimetric mothod. Calcium, magnesium, organic matter and postassium contents were also determined by the methods outlined by Jackson (4). Nitrogen content was estimated by usual Kjeldahl method.

RESULT AND DISCUSSION.

Analytical data of the irrigation water are presented below:—

Specific conductivity ..	1.13 mMHos/cm.
Total soluble salts	14.125 meq/L.
Na+ ..	0.5 meq/100 ml.
K+ ..	0.015 meq/100 ml.

Through mechanical analysis of soil samples, the following components were estimated:—

Depth (inches)	Pebbles %	Sand %	Clay %	Silt %
3	23.0	41.6	14.8	20.6
27	20.0	44.7	15.0	20.3

Chemical analysis of the soil samples was confined to the estimation of available constituents as well as estimation of pH, nitrogen and organic matter. The analytical data are presented in the following table:

Table 2

Depth (inches-.)	pH	Ca	Mg	Na	K	P	N (%)	Organic Matter (%-)
		AVAILABLE						
		meq	100,g.	soil		p. pm		
3	8.8	11.7	4.8	0.3	0.1	0.05	0.119	1.55
27	8.4	11.9	3.7	0.3	0.1	1.00	0.059	0.88

Mechanical analysis (Table 1) indicates sandy-loam texture of soil. Such a texture, with other favourable physical conditions, should favour deep and unrestricted penetration of roots. The pH of soil (Table 2) is, however, distinctly alkaline (8.4 to 8.8). Swan (5), while discussing the effects of pH on the absorption of nutrients states that the effects of soil pH are complex involving the change in the solubility of various nutrient elements as well as influencing the activity of soil organisms which are responsible for nitrification and other biological processes. The alkaline pH renders some of the micro-nutrients like iron, copper, maganese and zinc less soluble causing deficiency symptoms in plants. de Phillips and Giordano (2) are of the opinion that broad:-leaved species in certain ecosystem, in a given climate, tolerate, pH opto 7.

This high pH of the soil under reference indicated presence of fairly high proportion of basic ions. The soil was found to contain 41.2 % free $CaCo_3$.

In order to improve the environment of such soils, de Phillips and Giordano (2) suggested mixing of soil with peat or application of ammonium sulphate, sulphuric acid etc. Flower of sulphur is also applied for the same purpose.

The soil was deficient in nitrogen, being in the range of 0.059 to 0.119 %. Broadly speaking, the nitrogen content in upper 6″ layer of virgin forest soils varies from 0.1 to 0.3%, and a content of 0.2% is considered adequate for most of the tree species (7). Since the annual consumption of available nitrogen by young seedlings is fairly high, the growth of plants is liable to be adversely affected in case of deficiency of this element, especially during active period of plant growth. To overcome nitrogen deficiency under such conditions, Swan (6) recommends application of ammonium sulphate, particularly in sandy soils having low buffer capacity, where it also causes a decrease in soil's pH.

The available phosphorus, being in the range of 0.05 to 1.00 ppm, is very low. In the lower range 10 to 15 ppm. of phosphorus is considered bare minimum to suffice for plant needs and 50 ppm. of available phosphorus is sufficient for most of the tree species (7).

Potassium content, which generally varies between 50 and 200 ppm. in virgin forest soils(7)., was also low (39.1 ppm). Calcium varied between 11.7 and 11.9 meq/100g. soil. As regards its normal consumption, even the calciphilous plants require about 5 meq. of it per 100 gm. of soil (7). Available magnesium content in forest so ls is usually from 1/5 to 1/3 of that of the calcium content. In the soils analysed, this ratio was quite satisfactory, being almost 1/3 of the calcium content. Satisfactory growth has been noticed even at Ca/Mg ratio exceeding 30 (7). Sodium content (0.3 meq. per 100 g. soil) was too low to warrant any danger, since a level of 15 me. Exch. Na^+ or above is considered injurious for soil's relations to plant's growth.

CONCLUSION.

The tilth and other physical characters of the soil are favourable for development of normal growth pattern of the root system of plants. Irrigational water appeared normal in its constitution hence the mortality of seedlings could not be attributed to it. The soil's high pH (8.4 to 8.8), and considerable proportion of free CaCo3 content, however, could restrict the availability of iron, phosphorus, boron, zinc and maganese, resulting in imbalance of plant nutrition. The situation can further aggravate due to the fact that the virulence of some parasitic fungi is also directly proportional to the pH values, being at its peak in alkaline soils (7).

SUGGESTIONS FOR IMPROVEMENT.

To correct the abnormality, it is essential to view simultaneous correction of pH and supplementation of major essential nutrients through application of commercial fertilizers. Application of ammonium sulphate at a rate of 80 to 120 lb N per acre, in split doses, should benefit the plants through supply of much needed nitrogen and through part correction of soil's reaction, affecting uptake of the nutrients. On lowering the pH, phosphorus, potassium and other similar elements, which might have become inert due to the soil,s psresent chemical state, are expected to get released from their complex formations and become available to the plants. Application of superphosphate at rates of 120 lb. P_2O_5 per acre would further improve the situation by making additional quantity of P_2O_5 readily available to the plants.

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