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NUTRITIONAL MANAGEMENT OF *Morus alba* FOR GOOD QUALITY COCOON PRODUCTION

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ABSTRACT

Morus alba is the sole plant, the leave which is fed to the *Bombyx mori.* The quality of leaves with micro and macro nutrients such as N. P. K. and Zn are required for proper growth of III[rd] instar onward. Deficiency of any trace element in the plant may effect not only the growth of the larve but the production of cocoon and thread as well.

Keywords : Nutritional management, Cocoon production, *Morus abla*

INTRODUCTION

The mobility of nutrients in the plant is the normal function of the plant in order to meet its growth and development requirements. The mobility of nutrient is grouped into four categories based on their mobility as :

(i) Hight mobile (N. P. K.)
(ii) Moderately mobile (Zn)
(iii) Less mobile (S, Fe, Mn, Cu, Mg and Cl)
(iv) Immobile (Ca and B)

Fertilizers play an important role for good growth of mulberry. Among the nutrients in fertilizers nitrogen has the greatest influence on the quality of mulberry leaves. With the increased supply of nitrogen, the percentage of crude protein in the leaves is increased.

The nutritional management of mulberry is very difficult one unlike other crops. It is fascinating to note that plant leaf tissue analysis has revealed the presence of some sixteen elements in the leaf. Of these sixteen elements, six elements viz. Nitrogen (N), Phosphorus (P), Potassium (K) are primary nutrients. Calcium (Ca), Magnesium (Mg) and Sulphur (S) are used in large quantities by the plants as secondary nutrients, while other seven viz. Zn, Fe, Cu, Mn, B, Mo and Cl are called micro nutrients.

However, these mineral nutrients have been classified on the basic principle of Arnon and Stout[1]. According to them, an elements is essential when -

(i) Its deficiency prevents the plant from completing the vegetative or reproductive stage

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of its life cycle.

(ii) The shortage is specific for a given element being corrected only when the same is supplied.

(iii) The element has to be directly involved in the metabolism of the plant. Its effect is not a result of an eventual correction of unfavourable physicochemical or microbiological condition in the soil or in the culture medium. Brandis[2] classified the mulberry species into four by the length of the style and subdivided one section by length and shape. The experiment on systematic study on sericulture was started in Japan after establishment of the sericultural experiment station. The National sericulture experiment station was set up in Tokyo. Mulberry variety sometime referred to species, *morus alba, morus indica, morus nigra, morus sinensis and morus multicaulis* are reported. It has been reported that many varities of mulberry were introduced into India from Europe.

Cultivation as well as production of good quality cocoon is there at central sericulture research centre and other places in Karnataka state. The sole plant on which the larvae feed upon the nutritional management was studied to see the effect on growth development and metamorphosis which are essential factors required for good quality cocoon. Thus in the present study, it was proposed to work out the following aspects :

(i) Proper nursery and plantation of mulberry.

(ii) To observe the deficiency symptoms of mineral nutrient in the host plant.

(iii) To observe the growth moulting and metamorphosis effect of the host plant on the various stages of silkworm under laboratory conditions..

EXPERIMENTAL

Culture of Bombyx mori

The culture was carried out in Sidhique Ganj Field Station, Sironj and Vidisha in Chawki rearing method.

Morus alba

Nutritional status of mulberry leaves for the ideal growth of silkworm

The growth and healthy development of the silk worm very much depend upon the quality of leaves fed. Mulberry leaf is the primary feed of domesticated silkworm, *Bombyx mori* to produce raw silk. The silk worm take necessary nutrients for the growth only from mulberry leaves. Lepidopterous larvae are known as more or less continuous feeders, hence, a deficiency in the amount of food required for rearing will be main feeded in the larvae.

The quality of leaves is dependent on mulberry variety, climatic conditions, type of soil, irrigation, fertilizers and harvesting methods. Minerals, like N, P, K, Ca, Mg, Si, Fe, etc. are essential for the plant growth. Large quantities of nutrients are absorbed from the soil by the crop.

RESULTS AND DISCUSSION

Silk moth *Bombyx mori* is a monophagus insect, which feed upon the leaves of the mulberry plant *Morus alba. Morus alba* of family moraceae is the only host plant for this insect. Therefore, proper nutritional management of the host plant is very essential for the proper growth, metamorphosis and moulting of the insect.

During the study period, it was observed that the tender mulberry leaves contain high percentage of moisture. The loss of weight in percentage in tender leaves was found maximum as mentioned in the Table-1. Results of the chemical composition of mulberry fraction from various sources as presented in Table-2 showed that crude protein content from the leaf varies from 167 in Kanvas into 182 M.P.W. During the study period, mineral constituents of ash of mulberry leaves was analysed with the help of atomic absorption spectroscopy and spectrophotometery in RRL (C.S.I.R.) Bhopal. The mineral constituents of ash of mulberry leaves were shown as Table-3.

Table-1

Showing loss in weight in Mulberry Leaves 100 g tender leaves.

Weight of tender leaves	Dry weight of leaves	Loss in weight (percentage)	Ash contents 2.5%	
			Acid soluble	Water soluble
50 g	12 g	38 g (76 %)	1.6 %	40 %

Table-2

Chemical Composition (% of dry matters) of Mulberry Leaves.

Name	CP	CF	ADF	ASH (%)	Ca (%)	P (%)
Kanva-1	16.7	11.3	18.7	17.3	1.8	0.14
Mpwapwa	18.6	–	20.8	14.3	2.4	0.24

Table-3

The Mineral Constituents of Ash of Mulberry Leaves

Mineral constituents of ash of mucbery leave	Composition of ash (%)
Cu	0.6375
Ca	2.196
Mn	0.059
Cr	N.D.
Ni	0.028
SiO_2	0.491
K	46.04
Mg	3.190
Sb	0.990
Fe	40.680
Co	0.010
Zn	0.020

It has been noticed during three years that the mulberry leaves is an ideal place for sericulture purpose in the district, satisfying atleast the quantitative requirement for the silkworm larvae. The larvae fed on these minerals were found to have increased larval weight and cocoon quantity, when an artificial spray was made on foliar leaves in laboratory conditions. The minerals such as K, P, Zn and Mg play very important role in the nutrition of silkworm. Any deficiency in the soil ultimately causes adversely the development of mulberry and its effects on silkworm. All the nutrients play an important role for the growth and metamorphosis of silk moth larvae. All the analysis has been reported in Table-4.

Table-4

Comparative Requirement for Minerals of Silk Worm Bombyx mori with the Amount of Mineral found in the Leaves

Mineral	Mineral Optimum amount required mg/g of dry weight	Amouont present in mulberry leaves mg/g of dry matter
K	9.0	25-33
P	2.2	1.6-3.5
Mg	1.3	1.89-4.6
Zn	0.04	0.021

In fact, for sericulture purpose, suitable leaves mean those which are adequate to be eaten and digested by larvae of *Bobyx mori.* Chemically, as indicated in the table; the leaves, which contain all the nutrients are required by the larvae of the silkworm. Feeding to the young larvae needs careful handling as the leaves should not be too hard, comparatively rich in water and should contain much of proteins and carbohydrates. Slightly different nutritional requirement is needed for the growth of larvae i.e. form III[rd] instar onwards. Leaves should be too soft comparatively, less in water content and rich in protein. It has been noticed during this period that young larvae specially I[st] instar can not eat or digest hard leaves and demand large amount of water, protein and carbohydrates, probably due to their quick growth, while grown ones, i.e. 5th instar larvae demand less water than younger once. But owing to quick growth of silk gland, which secretes silk substance for cocoon making, they need much protein, fats and lipid diets as indicated in Table-5.

Table-5

Required Nutritional Status of Mulberry Leaves for Silk Worm Growth Agewise

Components, kinds of invesrigation (mulberry leaves)	Percentage in fresh leaves		Percentage in dry leaves				
	Water	Amount of dry matter	Crude protien	Crude fat	Cride fibre	Ash	Carbohydrates
Ist age larvae	32.07	17.93	36.35	3.17	9.27	8.11	12.23
IInd age larvae	78.99	21.01	31.04	3.19	9.52	7.23	17.71
IIIrd age larvae	77.49	22.51	28.29	2.28	10.50	7.33	18.67
IVth age larvae	78.40	21.60	27.35	3.49	10.79	7.97	18.02
Vth age larvae	75.65	24.35	26.16	3.49	10.71	7.20	20.21

The nutrient diet affects the weight of the cocoon as well as silk ratio. During the present study, it was noticed that when low nutrient diet was given to the silk worm, the date of the cocoon and silk ratio reduced the weight of cocoon and ratio of sufficient nutrient diet. Similar views have been reported by Tuch kove[3] and Saxena[4]. It was also observed that IIIrd instrar larvae fed nutrient rich leaves may attain good growth. The P, Ca contents in the leaves also affect nutrient value. Calcium content must be between 1.8-2.4% for proper growth of 5th instar larvae. When the ash content of mulberry leave were determined, it was observed that leaves content showed high percentage of potassium (K), but Cr was not detectable (Table-3). As indicated in Table-4, important minerals line K, P, Mg and Zn are required in 9, 8, 22, 15 g of dry weight, though these are present in much higher quantity in the leaves on the *Morus alba.*

Subharathinam and Krishnan[5] noted that the suppliment of potassium in the diet may increase the larval body weight and cocoon weight. Similar increase in the percentage weight was also noticed in the present study. From IIIrd instar onwards, leaves should be soft, less in water content and rich in protein.

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