Advance Production Technology of

Dill (Sowa)

(*Anethurn graveolens*)

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Correct Citation: Y.K. Sharma, M.M. Anwer, S.S. Meena and S.N. Saxena (2010). Crop Production Technology of Dill (Sowa).
ICAR-National Research Centre on Seed Spices Tabiji. Ajmer- 305 206 (Rajasthan)

Published by: Director,
ICAR-National Research Centre on Seed Spices
Tabiji Ajmer 305 206, Rajasthan
Phone- 0145-2684400
Fax- 0145-2684417
Email: nrcss.director@gmail.com
Website :nrcss.icar.gov.in

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Photographs by: M.A. Khan and G.K. Tripathi

Printed: January 2010 (500 Copies)

First edition: 2010

Revised in: 2021

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Printed at: Job Offset Printers
Ajmer
98294 72031

PREFACE

Dill is one of the important seed spices crop, mainly grown for culinary purpose and medicinal uses. Seeds and oil of dill are used in preparation of various medicines. The chief producers of dill in the world are India, Pakistan, China, Western Russia, Hungary and Egypt. Major importing countries of dill seed, seed powder and dill oil are USA, Japan and Germany.

In India dill is mainly cultivated in the states of Rajasthan, Gujarat, Punjab, Karnatakaand West Bengalfor its seeds. Dill including Celery and Poppy covered an area of 36000 ha with the production of 33000 tons (2018-19, NHB). The productivity level of dill crop in the country is very low as this crop is traditionally cultivated on marginal lands.

Looking to the importance and export potential of dill crop, this bulletin is prepared to compile advance production technology of dill crop to get good seed yield under different agro-climatic regions of India. The technology that has radiated out of research efforts made at NRC on Seed Spices, Ajmer and different centres located in the different agro-climatic regions. Under the AICRP on spices at SAU's has been complied in this publication. We are sure that this publication shall prove highly useful to various stake holders such as field functionaries, growers, exporters, students and others having interest in raising of dill crop scientifically.

We hope that the technical bulletin provides relevant information. Suggestions if any, for its improvement are welcome for future improvement.

Ajmer Authors

27/01/2010

Introduction

Dill is primarily a summer crop of temperate regions, but it has also adopted to grow in warmer areas to produce herb. The dry and cool climate is suitable for dill cultivation. In north Indian plains it is grown during *rabi* (winter) season. It requires cold weather for early vegetative growth and warm sunny days for seed formation and seed maturity. A temperature of above 30°C and below 7°C is not favourable for its growth and development. The humid climate is not suited for the crop as it favours to the appearance of diseases and pests during flowering or early maturity. It can tolerate higher rainfall but water logging is not favourable for the growth.

Soil

Dill can be grown on a wide range of soils. In heavy black soils with high moisture retention capacity, it is grown as a rainfed crop, while in light soils it is cultivated as an irrigated crop. Lower to medium fertility is appropriate for good seed yield and for leaves high fertility is advisable. It can be grown successfully in saline sodic soils, however very high salinity and sodicity hampers the growth and yield of crop. Deep and frequent irrigations are not advisable for higher growth and yield including insect-pest and disease infestation.

Recommended varieties

Dill is considered a minor seed spices crop and not much attention has been paid to its breeding. There are two closely related cultivated species of dill i.e. European type dill (*Anethurn graveolens*) and Indian type dill (*A. sowa*). Farmers cultivate the local varieties using their own seed. Mehasana local and Ruby local are grown in Gujarat and Pratapgarh localin Rajasthan. National Research Centre on Seed Spices has developed and recommended two improved varieties of dill for general cultivation. The name and general characteristics of the varieties are given as under.

Name of the variety	**Characteristics**
Ajmer Sowa 1 (NRCSS-AD-1)	• It is a European type dill variety which is suitable for cultivation under irrigated conditions. • The leaves are dark green in colour. • It is suitable for export as seeds of the variety are dillapiole less and contain about 3.5% essential oil. • The average plant height is 134 cm. • It takes about 142 days to maturity. • Average seed yield is 14.7 q/ha under irrigated conditions.
Ajmer Sowa 2 (NRCSS-AD-2)	• It is of Indian type dill variety suitable for cultivation both under irrigated and rainfed conditions.

	• The seeds are bold, compact and dark brown in colour, which require pressure to split. • The average plant height is 90 cm. • It takes about 135 days to reach maturity. • The average seed yield is 14.6 q/ ha under irrigated conditions and 5.8 q/ ha under rainfed conditions. • The seed contain about 3.2% essential oil.

Field preparation

The soil should be prepared well into good tilth before sowing by one deep ploughing with soil turning disc plough followed by two ploughings with harrow. For rainfed/unirrigated crop production moisture is conserved by ploughing and planking after rains. The field should be well leveled before sowing for better germination.

Sowing time

The dill crop is cultivated as annual crop sown generally during *rabi* and early *rabi* season. Time of sowing has a significant effect on plant growth and seed yield. However, it may vary with the climatic conditions of the area. The rainfed crop is sown early in the season in the month of August-September. The irrigated main *rabi* season crop is sown in the month of October preferably during 15-30th October. Delayed sowing after 30th October reduced seed yield as well as volatile oil content.

Sowing method

The general practice of sowing of dill is by broadcasting of the seeds in the field. But line sowing is better to facilitate intercultural operations effectively in the field. The seed should be sown 1.5 to 2.0 cm deep. The row spacing should be 50-60 cm for European type dill and 40-50 cm for Indian type dill. Plant to plant distance should kept 20 cm in both the cases. A light irrigation is required just after sowing if initial moisture in soil is not sufficient. The seeds take 10 to 12 days to germinate. The soil temperature should be around 30°C with sufficient moisture content for better germination of dill seeds.

Seed rate

Cleaned, bold and healthy seeds should be selected for easy and even germination. Preferably seeds less than 2 years old should be used. Soaking seeds in water for a day before sowing accelerates the germination. The seed rate depends on the sowing method used and irrigation conditions. A higher seed rate is required for broad casting method under rainfed cultivation as

compared to line sowing and irrigated conditions. The seed requirement is 3 kg/ ha for irrigated and 5 kg/ ha for rainfed conditions.

Seed treatment

The seed should be treated with seed dresser fungicides like thiram or captan or carbendazim @ 2.5-3.0 g/kg seed before sowing to get rid of soil borne and seed borne pathogens. There should be uniform and sufficient coating of the fungicide on the seed surface.

Manure and fertilizers

Dill crop requires good fertility status providing all nutrients as it responds well to fertilizer application. The application of fertilizers can effect seed yield and seed oil composition, hence it is needed to apply the balanced dose of nutrients in the form of fertilizers at right time. The soil should be tested before sowing for nutrient status of the field and nutrients should be applied as required in the form of manures and fertilizers after soil testing report. The general manures and fertilizers application should be given as under.

Irrigated conditions

Well decomposed FYM or compost @ 10 t/ ha should be applied at time of field preparation. Additional nutrients should be applied through fertilizers. The application of 90 kg nitrogen, 40 kg phosphorus and 20 kg potash has been recommended for higher seed, straw and biological yield under semi arid conditions. The 1/3rddose of nitrogen is to be applied as basal dose at the time of sowing with phosphorus and potassium. Remaining quantity of nitrogen should be applied in two split doses first at 30 days after sowing and second at flowering stage as top dressing.

Rainfed conditions

Under rainfed conditions the manure should be applied in form of well decomposed FYM or compost (10 t/ ha) once in two years. The fertilizer requirement is 40 kg N, 30 kg P,O, and 20 kg K2O per hectare. The fertilizers should be applied at the time of sowing.

Inter-cultural operations

Thinning:

Thinning should be done 3 weeks after sowing and plant to plant distance should be maintained 15-20 cm.

Hoeing and Weeding

The initial growth of dill crop is slow, therefore it is necessary to keep the field clean and weed free by proper weeding and hoeing. In general, two or three manual or mechanical weeding is

required. First weeding and hoeing should be done in about 3-4 weeks after sowing. Next weeding should be done whenever required at 30 days interval. Weed can also be controlled by pre-emergence application of oxadiargyl @ 0.075 kg/ha or spraying pendimethalin @ 0.75 to 1.0 kg /ha after sowing or oxadiargyl @ 0.075 kg/ha + one hand weeding at45 days after sowing. There should be sufficient moisture in the soil at the time of weedicide application to ensure better weed control by the chemicals.

Intercropping and crop rotation

Little is known about intercropping and crop rotation with dill. In general dill should be grown as sole crop to get the good results of seed yield. However, it can be intercropped with onion and carrot during *rabi* season. The crop should be grown by following 3-4 years crop rotation for healthy crop cultivation.

Irrigation

Dill crop plants should be irrigated as required for its better growth during cropping period. The crop is sown under irrigated conditions in the light soil as well as unirrigated condition as a rainfed crop in black cotton soils. Under irrigated conditions a pre planting irrigation is required to wet the seed bed. If soil moisture is not sufficient at the time of sowing a light irrigation can be given just after sowing for proper germination. At the time of flower initiation and seed development stage sufficient soil moisture should be available to the crop. In all, 3-4 irrigations are sufficient to raise the crop. Irrigation interval of 15 days proved better in terms of seed, straw and biological yield.

Diseases

Dill is susceptible to a number of plant pathogenic fungi, but the damage is extensive in respect of root rot and foliar diseases like powdery mildew and blight. The disease incidence and damage on dill crop depends on the climate and soil conditions. Humid and moist conditions generally favour the appearance and spread of diseases. The important diseases of dill are described as under.

Powdery mildew

Powdery mildew in dill is caused by fungus *Erysiphepolygoni*. The symptoms of the disease appear on all green plant parts including leaves, stem, and inflorescence as white powdery mass. The symptoms, later on extended to other parts of plants including seeds, which affect yield as wellas quality of seeds.

The disease can be effectively controlled by sulphur dusting @ 20-25 kg/ha at the initial stage. Spraying with dinocap (0.1%) or wettableSulphar (0.2 %) is also effective for the management of disease. First spray should be given on the appearances of disease and repeated at an interval of 10-15 days if required depending on the spread of disease.

Root rot

Root rot is cause by fungus *Fusarium* spp. The disease symptoms can appear in all growth stages, but early vegetative growth stage is more affected with the disease. The leaves showing chlorosis initially become yellow and ultimately the plant dries and dies prematurely. The affected plant roots show browning and rotting. The disease can cause severe yield losses if it appears early in the season.

Phytosanitary measures and seed treatment are important for controlling the disease. Seed treatment with carbendazim (2g/kg seed) or biofungicide*Trichoderma* @ 4 g/kg seed are effective to control the disease.

Other diseases

Dill crop is also affected by several other diseases of minor importance at regional levels. The list of diseases and their causal organism are given below.

- Damping off- *Pythium spp., Rhizoctonia spp.*
- Seedling blight - *Alternaria radicina*
- Leaf spot - *Ascochytaanethicola*
- Head rot - *Botrytis spp., Alternaria spp.*
- Scab - *Fusicladium spp.*
- Rust -*Pucciniapetroselini*
- Celery mosaic virus

Control measures of these diseases may be obtained from regional/ local Agricultural Research Stations in case of the appearance ofthese minor diseases.

Insect pests

Dill is frequently attacked with insect pests of the locally important vegetable crops and other umbelliferae crops, but the damage is comparatively less. The crop is generally attacked by insects like aphid, cutworm and leaf eating caterpillars.

Aphid

It sucks tender part of the plant and flowers resulting in yellowing of crop and shrivelled grains. It can be controlled by spraying of endosulfan (35 EC) 0.07% @ 500-600 litres/ha solution, which is

considered a relatively safer insecticide and should be used in evening when insect population is least.

Leaf eating caterpillar

The caterpillar generally damages the leaves of the plant. It can be controlled by spraying of endosulfan 0.05% once or twice depending on caterpillar population.

Harvesting

The harvesting time of dilldepends upon the purpose for which it is grown. When it is grown for vegetable purpose it can be harvested at 4-5 leaves stage. When it is grown for seed purpose the crop is harvested at maturity. The crop matures in 130-150 days and can be harvested in April. Harvesting is done by cutting the plants with sickle 40 cm above ground level when seeds of main umbel turn brown. Delay in harvesting results in shattering of grains into the field. The harvested dill plant bundles should be dried under shade and threshed either manually by beating with stick or mechanically in a seed spices thresher.

Threshed seeds should be cleaned, dried and stored in ventilated bins to minimize the losses during storage.

Yield

On an average the yield is 10-15 q/ha under irrigated conditions and 6-7 q/ha under rainfed conditions. This seed yield of dill can be obtained under better management of crop production.

Processing

The oil of dill can be extracted from both herbs and seeds. For the production ofdill herb oil, fresh plants are chopped into 2-3 pieces and distilled immediately. Oil is extracted from dried fresh seeds through steam distillation. The quality of oil received from seeds is superior. An essential oil yield of 0.9 to 1.5% and 2.5 to 4% can be achieved from herbs and seeds respectively. The volatile oiland oleoresins extracted from dill seed has its demand in pharmaceutical, cosmetics and food industry. Following are the important processed products of dill.

- Herb essential oil
- The dried fruit or spice dill seed
- Seed essential oil
- Oleoresin

Other information on Dill

Origin

It belongs to the family Apiaceae and genus *Anethum*, which includes two species *A. graveolens* L. (European type) and *A. sowa Roxb.* (Indian type). Dill is one of the minor seed spices crop mainly grown for spices and medicinal uses. Probably dill is native to the Mediterranean West Asia and is one of the oldest cultivated seed spices from ancient times. Europe, Africa and Asia are considered as centre of origin for dill crop. Initially dill was used as one of the herbs for flavouring in dynastic Egypt and for flavouring and medicine by the Greeks and Romans. It was commonly known as dill in Europe as early as 1000 A.D., where it was carried by Roman armies. By Medieval times, it had become a common culinary herb and pickling spice. European dill was deliberately introduced to the Jammu and Kashmir regions in India as a potential crop in the early 1950s and later to other suitable areas.

Distribution, area and production

Dill is cultivated worldwide including India, Pakistan Germany, Hungary, Netherland, and USA. In India dill is grown with the name of sowa in the states of Rajasthan, Gujarat, Punjab, Karnataka, West Bengal,J & K, Uttar Pradesh, Orissa, and Madhya Pradesh for its seeds. In Rajasthan dill producing districts are Chittorgarh, Nagaur, Jhalawar, Udaipur, Kota and Bundi. In India, the area covered under dill including celery and poppy cultivation is 0.36lakh ha with the production of 0.33lakh tons in total for all above crops (2018-19, NHB).

Uses

There are diverse uses of dill plant. The young tender leaves are used for culinary purposes and seeds are used as spices. Apart from these, it is also used for medicinal purposes.

Culinary Uses

Dill seeds are used both whole and ground as a condiment in soups, salads, processed meats, sausages, spicy table sauces and in dill pickling. Dill stems and blossom heads are used for dill pickling and for flavouring soups. The green herb is used as a flavouring agent.

Medicinal and therapeutic Uses

Both seeds and oil are used in the preparation of various indigenous medicines. It has a prominent place for stomach problems, especially in the ailments of children and women. The essential oil, dill oil or its emulsion in water commonly known as dill water is considered to be an aromatic,

carminative specially useful in control of flatulence, colic pain, hyperacidity, vomiting, diarrhoea and hiccups due to indigestion in infants. Its application with turmeric powder prevents formation of ulcers and heals them quickly. Leaves boiled in sesame oil makes an excellent liniment for reducing swelling and pain of the joints. Seeds are effective in respiratory disorders like cold, influenza and bronchitis. It is useful in inflammatory and painful conditions of piles for which it is used with vacha as fumigation therapy. It is very useful for women during delivery for expulsion of placenta and promotes milk secretion.