

बिहार सरकार,
कृषि विभाग

पत्र सं० - पी०पी०एम०-43/2016

1466

/कृ०, पटना दिनांक 21-03-2018

प्रेषक,

सुधीर कुमार,
प्रधान सचिव,
कृषि विभाग, बिहार।

सेवा में,

महालेखाकार, बिहार,
बीरचन्द पटेल पथ, पटना।

#अनौपचारिक रूप
से परामर्शित

#द्वारा - वित्त विभाग, बिहार, पटना।

विषय-

बिहार राज्य बीज निगम के 15 कंक्रीट छत वाले बीज गोदामों में Dehumidifier लगाने हेतु सहायक अनुदान योजना मद में 1253.72 लाख (बारह करोड़ तिरपन लाख बहतर हजार) रुपये के लागत पर योजना कार्यान्वयन एवं व्यय की स्वीकृति।

आदेश : स्वीकृत।

बिहार राज्य बीज निगम के 15 कंक्रीट छत वाले बीज गोदामों में Dehumidifier लगाने हेतु सहायक अनुदान योजना मद में 1253.72 लाख (बारह करोड़ तिरपन लाख बहतर हजार) रुपये के लागत पर योजना कार्यान्वयन एवं व्यय की स्वीकृति प्रदान की जाती है।

2. Dehumidifier की स्थापना से बीज में नमी को नियंत्रित रखकर गोदामों में भंडारित बीजों की गुणवत्ता बनाये रखने एवं गुणवत्तायुक्त बीजों को ज्यादा समय तक भंडारित किया जा सकता है।

3. बिहार राज्य बीज निगम के कुदरा, हाजीपुर, बेगूसराय एवं भागलपुर के गोदामों में नमी को नियंत्रित कर बीजों की गुणवत्ता बनाये रखने हेतु Dehumidifier संयंत्र लगाया जाना है। निगम के पास वर्तमान में 3.62 लाख क्वी० भंडारण क्षमता उपलब्ध है जो वर्ष 2017-18 में बढ़कर 7.62 लाख क्वी० हो जायेगी, जिसमें तत्काल 1.50 लाख क्वी० बीज को निर्धारित मापदंड के अन्तर्गत नियंत्रित कर सुरक्षित रखने के लिए 15 गोदामों में Dehumidifier संयंत्र लगाया जाना है। जिसका विवरण निम्न प्रकार है :

| क्र० सं० | स्थल का नाम | कंक्रीट छत वाले गोदाम का स्पेसिफिकेशन | गोदामों की क्षमता (क्वी० में) | गोदामों की सं० |
|----------|-------------|---------------------------------------|-------------------------------|----------------|
| 1 | कुदरा | 82 X 80 X 18 | 70000 | 07 |
| 2 | कुदरा | 97 X 48 X 18 | 20000 | 02 |
| 3 | हाजीपुर | 82 X 80 X 18 | 20000 | 02 |
| 4 | बेगूसराय | 82 X 80 X 18 | 20000 | 02 |
| 5 | भागलपुर | 82 X 80 X 18 | 20000 | 02 |
| | | कुल | 150000 | 15 |

A. Dehumidifier संयंत्र लगाने हेतु BRY- AIR (ASIA) Pvt. Ltd., Kolkata से प्राक्कलन प्राप्त किया गया है। जिसके अनुसार Estimated Cost of BRY- AIR Dehumidifier Model Fli-

10500 with 36 condensing unit for Godown size- 82' X 80' X 18' का निम्नवत है- (अनुसूची-1 संलग्न)

| S.No. | Item | Total Price in (Rs.) |
|-------|--------------------------------------|----------------------|
| 1 | Price | 6365000.00 |
| 2 | Taxes & Duties @23% | 1463950.00 |
| 3 | Freight charges (approx) | 55000.00 |
| 4 | Installation & Commissioning Charges | 145000.00 |
| 5 | Cost of ducting & others (approx) | 110000.00 |
| 6 | Cost of Insulation (approx) | 430000.00 |
| | Total | 8568950.00 |

B. Estimated Cost of BRY- AIR Dehumidifier Model Fli- 7300 with 26 condensing unit for Godown size- 97' X 48' X 18' का निम्नवत है- (अनुसूची-2 संलग्न)

| S.No | Item | Total Price in (Rs.) |
|------|--------------------------------------|----------------------|
| 1 | Price | 5191000.00 |
| 2 | Taxes & Duties @23% | 1193930.00 |
| 3 | Freight charges (approx) | 45000.00 |
| 4 | Installation & Commissioning Charges | 118000.00 |
| 5 | Cost of ducting & others (approx) | 90000.00 |
| 6 | Cost of Insulation (approx) | 350000.00 |
| | Total | 6987930.00 |

4. उपरोक्त के आलोक में 15 गोदामों में Dehumidifier संयंत्र लगाने हेतु आकलित राशि का विवरण निम्नवत है-

| क्र० सं० | स्थल का नाम | कंक्रीट छत वाले गोदाम का स्पेसिफिकेशन | गोदामों की क्षमता (क्वी० में) | गोदामों की सं० | दर प्रति Dehumidifier स्थापना एवं कर सहित (रु० में) | कुल राशि (लाख रु० में) |
|----------|-------------|---------------------------------------|-------------------------------|----------------|---|------------------------|
| 1 | कुदरा | 82 X 80 X 18 | 70000 | 07 | 8568950.00 | 599.82650 |
| 2 | कुदरा | 97 X 48 X 18 | 20000 | 02 | 6987930.00 | 139.75860 |
| 3 | हाजीपुर | 82 X 80 X 18 | 20000 | 02 | 8568950.00 | 171.37900 |
| 4 | बेगूसराय | 82 X 80 X 18 | 20000 | 02 | 8568950.00 | 171.37900 |
| 5 | भागलपुर | 82 X 80 X 18 | 20000 | 02 | 8568950.00 | 171.37900 |
| | | कुल | 150000 | 15 | | 1253.72210 |

5. गोदामों में बीजों की गुणवत्ता बनाये रखने हेतु नमी को नियंत्रित किये जाने के लिए Dehumidifier संयंत्र लगाया जाना है। गोदामों में नमी नियंत्रण के दौरान तापमान में भी वृद्धि हो जाती है, जो बीजों के अंकुरण क्षमता को प्रतिकूल रूप से प्रभावित करते हैं। अतः इसके नियंत्रण के लिए इस Dehumidifier के साथ Temperature Control की व्यवस्था भी इसमें शामिल है।

6. कडिका 3 में उल्लेखित राशि केवल लागत मूल्य की गणना हेतु ही मान्य है। गोदामों में Dehumidifier संयंत्र स्थापना के निमित्त बिहार राज्य बीज निगम को राष्ट्रीय स्तर पर निविदा प्रकाशित करनी होगी। साथ ही निविदा प्रपत्र में Dehumidifier के स्थापना हेतु निर्धारित की जाने वाली तकनीकी विशिष्टताएँ एवं तकनीकी शर्तों पर बिहार कृषि विश्वविद्यालय, सबौर से सहमति प्राप्त कर लेना आवश्यक होगा। निविदा निष्पादन के क्रम में बिहार वित्तीय नियमावली का अनुपालन सुनिश्चित किया जाना आवश्यक होगा। निविदा प्रक्रिया में प्राप्त न्यूनतम मूल्य दर के आधार पर वास्तविक राशि ही उपयोग की जा सकेगी। यदि राशि की और अधिक आवश्यकता होगी तो निगम द्वारा अतिरिक्त राशि की मांग की जायेगी।

7. स्वीकृत राशि की निकासी कृषि निदेशक, बिहार, पटना द्वारा सचिवालय कोषागार, विकास भवन, पटना से BTC-42 पर करते हुए Inter Departmental Transfer के माध्यम से बिहार राज्य बीज निगम के पी०एल०ए० खाता संख्या-271 में चालान (BTC FORM-4) द्वारा हस्तांतरित की जायेगी।

8. योजना का कार्यान्वयन प्रबंध निदेशक, बिहार राज्य बीज निगम के द्वारा किया जायेगा। प्रबंध निदेशक, बिहार राज्य बीज निगम द्वारा इकाईयों को स्थापित करने का कार्य निविदा प्रक्रिया में चयनित प्रतिष्ठान से करवाया जायेगा, जिसमें रख-रखाव एवं मेनटेनेन्स से संबंधित बिन्दु भी शामिल रहेंगे।

9. बिहार राज्य बीज निगम के द्वारा दिये गये प्रस्ताव के आलोक में सहायक अनुदान मद में प्राप्त राशि का उपयोग किया जायेगा। व्यय के पश्चात उपयोगिता प्रमाण पत्र विभाग को उपलब्ध कराया जायेगा।

10. प्रशासी विभाग द्वारा कार्यान्वयन में यथाआवश्यक संशोधन किया जा सकेगा।

11. वित्तीय वर्ष 2017-18 में बजट शीर्ष एवं उपबंधित राशि से संबंधित विवरणी निम्न प्रकार है:-
(राशि लाख रूपये में)

| बजट शीर्ष | उपबंधित राशि | स्वीकृत राशि |
|--|----------------|----------------|
| मुख्य शीर्ष-2401-फसल कृषि-कर्म, उप मुख्य शीर्ष-00, लघु शीर्ष-103-बीज, मांग सं0-01, उपशीर्ष- 0109-बीज गुणन फर्मों का विस्तार खेती पर व्यय विपत्र कोड-01-2401001030109 विषय शीर्ष-31.05 सहायक अनुदान परिसंपत्तियों के निर्माण | 1405.81 | 1040.59 |
| मुख्य शीर्ष-2401-फसल कृषि-कर्म, उप मुख्य शीर्ष-00, लघु शीर्ष-789-अनुसूचित जातियों के लिए विशेष घटक योजना, मांग सं0- 01, उपशीर्ष-0117 बीज उत्पादन कार्यक्रम, विपत्र कोड-01-2401007890117, विषय शीर्ष- 31.05 सहायक अनुदान परिसंपत्तियों के निर्माण | 271.00 | 200.59 |
| मुख्य शीर्ष-2401-फसल कृषि-कर्म, उप मुख्य शीर्ष-00 लघु शीर्ष-796-जनजातीय क्षेत्र उप योजना, मांग सं0- 01, उपशीर्ष- 0140-बीज उत्पादन कार्यक्रम, विपत्र कोड- 01-2401007960140, विषय शीर्ष-31.05 सहायक अनुदान परिसंपत्तियों के निर्माण | 16.94 | 12.54 |
| योग | 1693.75 | 1253.72 |

12. वित्त विभाग के संकल्प संख्या- 3758 दिनांक 31.05.2017 में निहित प्रावधान के आलोक में उक्त योजना के कार्यान्वयन में स्थायी वित्त समिति की स्वीकृति संचिका संख्या-पी0पी0एम0-43/2016 के पृ0सं0- 180/प. पर दिनांक : 30.10.2017 को प्राप्त है तथा माननीय मंत्री, कृषि का अनुमोदन पृष्ठ सं0-56/टि0 पर दिनांक 07.03.2018 को प्राप्त है।

13. वित्त विभागीय परिपत्र संख्या-7355 वि० (2) दिनांक 05.10.2007 के आलोक में महालेखाकार, बिहार, पटना से प्राधिकार पत्र की आवश्यकता नहीं है।

14. राज्यादेश प्रारूप में आंतरिक वित्तीय सलाहकार की सहमति संचिका संख्या-पी0पी0एम0-43/2016 के पृष्ठ संख्या- 58/टि० पर दिनांक: 20.03.2018 को प्राप्त है।

बिहार राज्यपाल के आदेश से

(सुधीर कुमार)

प्रधान सचिव,

कृषि विभाग, बिहार, पटना।

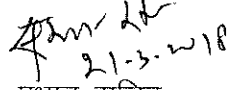
ज्ञापांक - पी0पी0एम0-43/2016 1466 /कृ०,पटना दिनांक 21-03-2018

प्रतिलिपि:- प्रभारी पदाधिकारी, अंकेक्षण, महालेखाकार, बिहार वीरचन्द्र पटेल पृष्ठ, पटना को सूचनार्थ एवं आवश्यक कार्रवाई हेतु प्रेषित।

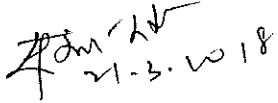
प्रधान सचिव,

कृषि विभाग, बिहार, पटना।

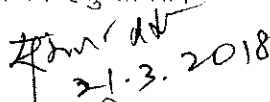
ज्ञापांक – पी0पी0एम0-43/2016 1466 /कृ0,पटना दिनांक 21-03-2018
प्रतिलिपि:- कोषागार पदाधिकारी, सचिवालय, विकास भवन, पटना को सूचनार्थ एवं
आवश्यक कार्रवाई हेतु प्रेषित।


21-3-2018
प्रधान सचिव,
कृषि विभाग, बिहार, पटना।

ज्ञापांक – पी0पी0एम0-43/2016 1466 /कृ0,पटना दिनांक 21-03-2018
प्रतिलिपि- माननीय कृषि मंत्री के आप्त सचिव/ कृषि उत्पादन आयुक्त के आप्त सचिव,
बिहार, पटना/प्रधान सचिव, कृषि विभाग, बिहार, पटना/विशेष सचिव, कृषि विभाग, बिहार,
पटना/कृषि निदेशक, बिहार, पटना/निदेशक उद्यान, बिहार, पटना/मिशन निदेशक, राष्ट्रीय
बागवानी मिशन/प्रबंध निदेशक, बिहार राज्य बीज निगम, पटना/सभी जिला कृषि
पदाधिकारी/सभी प्रमंडलीय संयुक्त निदेशक (शष्य)/सभी सहायक निदेशक, उद्यान/सभी उप
निदेशक, उद्यान/मुख्यालय स्थित सभी संबंधित पदाधिकारीगण/ बजट एवं योजना शाखा
(सचिवालय एवं निदेशालय), कृषि विभाग, बिहार, पटना को सूचनार्थ एवं आवश्यक कार्रवाई हेतु
प्रेषित।


21-3-2018
प्रधान सचिव,
कृषि विभाग, बिहार, पटना।

ज्ञापांक – पी0पी0एम0-43/2016 1466 /कृ0,पटना दिनांक 21-03-2018
प्रतिलिपि- उप निदेशक (शष्य) सूचना, बिहार, पटना/आई0टी0 मैनेजर, कृषि विभाग को
विभाग के वेबसाईट पर अपलोड एवं संबंधित पदाधिकारियों को ई-मेल करने हेतु प्रेषित।


21-3-2018
प्रधान सचिव,
कृषि विभाग, बिहार, पटना।

अनुसूची - 1

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Leaders in Dehumidification ... Worldwide

BRY-AIR (ASIA) PVT. LTD.

Shivam Chambers, 63 Syed Amir Ali Avenue, Kolkata 700019

Phone: +91 33 22814841, 22814877, 22814701

Fax: +91 33 22814850

E-mail: bryairkolkata@pahwa.com • www.bryair.com

N/BHR/100091/DE1001699/2017

24th April 2017

The Managing Director
Bihar Rajya Beej Nigam Ltd.
Pan: Bhawan, 6th floor
Bailey Road
Patna -- 800 001

Sub : Bry-Air Dehumidifier for Seed Storage

Dear Sir,

This is further to our letter of even number dtd. 20.04.2017.

Please find below our estimation :-

A : BRY-AIR DEHUMIDIFIER MODEL FH-10500 WITH 36 TR CONDENSING UNIT

| Sl No. | Item | Total Price in (Rs.) |
|------------|--------------------------------------|-------------------------|
| 1 | Price | 63,65,000/- |
| 2 | Taxes & Duties | 14,63,950/- |
| 3 | Freight Charges (approx) | 55,000/- |
| 4 | Installation & Commissioning Charges | 1,45,000/- |
| 5 | Cost of ducting & others (approx) | 1,10,000/- |
| 6 | Cost of insulation (approx) | 4,30,000/- |
| TOTAL COST | | 85,68,950/- |

Contd.....2/-

Registered Office: 20, Rajpur Road, Delhi 110054, India
Phone: +91 11 28906666 • Fax: +91 11 28906600 • E-mail: enquire@pahwa.com • www.bryair.com • CIN: U74210DL1981PTC012458
Branch Offices: Delhi • Chandigarh • Mumbai • Vadodra • Kolkata • Bengaluru • Hyderabad • Chennai • Kochi
International Offices: Bangladesh • Indonesia • Philippines • Vietnam • Nigeria • UAE
Plants: India • China • Malaysia • USA • Brazil • Switzerland

PAIWA GROUP
Innovation is life

अनुसूची-2

(6)



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BRY-AIR (ASIA) PVT. LTD.

www.bryair.com

- 2 -

B : BRY-AIR DEHUMIDIFIER MODEL FIL-7300 WITH 26 TR CONDENSING UNIT

| Sl No. | Item | Total Price in (Rs.) |
|------------|--------------------------------------|-------------------------|
| 1 | Price | 51,91,000/- |
| 2 | Taxes & Duties | 11,93,930/- |
| 3 | Freight Charges (approx) | 45,000/- |
| 4 | Installation & Commissioning Charges | 1,18,000/- |
| 5 | Cost of ducting & others (approx) | 90,000/- |
| 6 | Cost of Insulation (approx) | 3,50,000/- |
| TOTAL COST | | 69,87,930/- |

We now await your valued instruction with interest.

Thanking you once again and assuring you of our best attention at all times.

for BRY-AIR (ASIA) PVT LTD

TK Haldar
Regional Manager
Mob. 98303 37139
Email : tkhaldar@pahwa.com



Bihar Rajya Beej Nigam Ltd <brbn.bih.mail@gmail.com>

Ref:- PPM-43/2016-183 Patna Dated 12/02/2018

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DIRECTOR RESEARCH BAU SABOUR <drbau1908@gmail.com>
To: Bihar Rajya Beej Nigam Ltd <brbn.bih.mail@gmail.com>
Cc: Sailabala Dei <ddrbausabour@gmail.com>

Sat, Feb 17, 2018 at 11:16 AM

Sir,

Please find attachment.

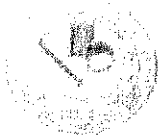
Regards,

P. K. Singh Ph.D.

Director Research
Bihar Agricultural University
Sabour, Bhagalpur-813210
Bihar, India
P. No.- 0641-2451056



BRBN0001.pdf
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BIHAR AGRICULTURAL UNIVERSITY, SABOUR
(BHAGALPUR) 813210, BIHAR

Dr. P.K. Singh, Ph.D
Director Research

Tele: (0641) 2451056 (M)-9431897516
E-Mail: drbau1908@gmail.com

File No. 431 /DR/BAU, Sabour L.N.O 1703 Date: - 16/2/2018

To,

Director Agriculture & Managing Director
Bihar Rajya Beej Nigam Ltd.
Pant Bhavan (6th Floor)
Jawaharlal Lal Nehru Marg
Patna-800001

Sub: - Technical Report on Dehumidifier and Temperature Controller.

Ref:- Your L. No. PPM-43/2016-183 dt 12/02/2018 addressed to the Vice-Chancellor,
BAU, Sabour

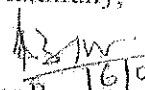
Sir,

The technical report on the Dehumidifier and Temperature Controller required for safe storage of seeds is attached herewith for your needful perusal. For further details you may contact Dr. Mukesh Kumar, Asstt. Professor, Seed Technology, BAU, Sabour in his e-mail id(mk.sabour@gmail.com) or telephone no (7091217593), if required.

With Thanks,

Enc:- As above

Yours faithfully,


16/02/2018
Director Research

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Utilities and Benefits of Dehumidifier and Temperature Controller in Seed Storage

| | |
|------------------------|--|
| Dehumidifier | <p>Utilities</p> <ol style="list-style-type: none"> 1. It lowers the relative humidity to facilitate handling of hygroscopic materials like seed. 2. It lowers the dew point to prevent condensation water vapour present in air on seed during storage. 3. It controls humidity in warehouses used for seed storage. 4. It maintains a dry atmosphere which is necessary for storage. <p>Benefits</p> <ol style="list-style-type: none"> 1. Extend the storage life of seed by preventing absorption of moisture present in air. 2. Preventing the mold growth and insect pest infestation. <p>During storage seed quality is reduced by attack of storage insect pest and mould (Fungus) growth. Their activity prominently depends upon available moisture and temperature of the storage environment. At low moisture content such as less than 12 % for cereals, most of the storage insect pest becomes inactive. Thus reduces the chance of post-harvest losses seed quality.</p> |
| Temperature Controller | <p>Utilities</p> <ol style="list-style-type: none"> 1. It is used to control the environmental temperature inside warehouse for seed storage. 2. Removal of excess heat generated through dehumidifier, respiratory activities of seed etc. 3. To lower the temperature of storage environment helps in preventing the growth of storage fungi and reduced the insect pest build up during seed storage. <p>Benefit</p> <ol style="list-style-type: none"> 1. Extend the storage life of seed by lowering the temperature of storage environment. 2. Temperature is one of the most important environmental factors, which influence seed viability and vigour during storage, the lower the temperature, the longer the seeds maintain germination capacity, thus temperature control is an important consideration in building seed storage. |

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CONTROLLED SEED STORAGE STRUCTURE: A TECHNICAL ANALYSIS

The purpose of seed storage is to maintain and make available good quality seed from the time they are harvested until the time they are planted.

Relative humidity and temperature by far are the most important factors determining the storage life of seeds. Seed attain a rather specific and characteristics moisture content when subjected to given levels of atmospheric humidities. This characteristics moisture content is referred to as equilibrium moisture content, for a particular kind of speed at a given relative humidity, tends to increase as temperature decreases and as deterioration progresses. Thus the maintenance of speed moisture content during storage is a function of relative humidity and to a lesser extent of temperature, at equilibrium moisture content, there is no net gain or loss in seed moisture content. Seed placed in an environment with a relative humidity higher or lower than that with which its moisture content is in equilibrium, will gain or lose moisture until equilibrium is established with the new environment. In sealed storage, seed moisture content determines the relative humidity of the environment in the containers.

Establishment of moisture equilibrium in seeds is a time dependent process. It does not occur instantaneously. A period of time is required, the length of which varies with the seed kind, initial moisture content, the average relative humidity and the temperature. Under open storage conditions, seed moisture content, fluctuates with changes in relative humidity. However, normal diurnal fluctuation in relative humidity has little effect on moisture content.

Table: Equilibrium moisture content at 25°C of seeds of important crops.

| Sr.No | Crop | 15% | 45% | 75% | 100% |
|-------|---------|-----|------|------|------|
| 1 | Maize | 6.4 | 10.5 | 14.8 | 23.8 |
| 2 | Rice | 6.8 | 10.7 | 14.4 | 23.6 |
| 3 | Sorghum | 6.4 | 10.5 | 15.2 | 21.9 |
| 4 | Wheat | 6.4 | 10.5 | 14.6 | 25 |

General Principles of Seed Storage

In view of the various factors affecting seed viability in storage, the following principles emerge as necessary for good storage.

- a) Seed storage condition should be dry and cool.

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- b) Effective storage pest control.
 - c) Proper sanitation in seed stores.
 - d) Before placing seeds into storage they should be dried to safe moisture limits, appropriate for the storage system.
 - e) Storing of high quality seed only, i.e. well cleaned, treated as well as of high germination with vigour and good pre-storage history.
 - f) Determine seed storage needs in view of period or length of storage time, and prevailing climate of the area during storage period.

The general requirement for good seed storage is a dry and cool environment. Seed operations located in climatic areas with high temperatures and relative humidities must have some system for controlling both the relative humidity and the temperature of the air inside seed storage rooms. Sealed storage (vapour proof containers) has been used for many years in the vegetable seed industry; however, two factors have limited the use of this method for storage of field crop seeds:

1. The cost of vapor proof containers, and
2. The moisture content of the seed must be 2-3% lower than that normally considered safe for seed packaged in non-moisture proof containers.

Before considering several systems that can be installed to maintain low relative humidities and temperatures, let us consider the basic requirements.

1. A structure must be provided that will keep infiltration of moisture and heat to a minimum;
2. There must be some means for dehumidification (removing moisture from the air); and
3. There usually must be some provision made for lowering the temperature of the air.

Construction of controlled Seed godown

The question of how to build a good seed storage room becomes a question of what is the best way to construct a "large container" and make it as air tight as possible. This is necessary in order to keep the initial cost and the operating expense of the dehumidifying and cooling equipment at a minimum.

For low humidity conditions, it is essential that adequate vapour barriers be included in the construction and that they be installed with the greatest of care making sure that all joints are properly sealed. Thermal insulation requirements will vary with geographic location.

Obviously, the size of the storage area should not be larger than absolutely necessary. If seeds are to be stored in a large warehouse, it is more economical to condition only a small portion of the warehouse rather than to attempt to dehumidify and cool the entire structure.

Dehumidification

Generally speaking, there are two major categories of dehumidifiers: refrigeration-type and chemical or adsorption-type.

Refrigeration-type

The refrigeration-type dehumidifier operates by drawing warm moist air over a metal coil through which a refrigerant such as Freon is circulated. A part of the atmospheric moisture condenses on this cooling coil and is collected in a pan or bucket or is drained off. The cooled air coming from over the coil which now has a low temperature and a high relative humidity is reheated by the condenser coil of the refrigeration system; thus raising the temperature and lowering the relative humidity.

The water removal capacity of this type of system is dependent on the difference in temperature between the entering air and the cooling coil. While these units are quite effective at high temperature, they lose efficiency below 70°F or 50% relative humidity. Heat from the electric motors that drive the compressor and fans add sensible heat to the atmosphere.

Adsorption type

The adsorption-type dehumidifier operates by drawing moist air over a solid drying agent (desiccant) which has the ability to extract and retain moisture on its surface by a phenomenon known as "adsorption." The air is filtered and dried to a very low dew point in the process, and the desiccant is periodically regenerated by means of heated outside air which vaporizes the moisture and dispels it to the outside of the conditioned space. Continuous operation of these machines is achieved by either using two desiccant beds which switch back and forth automatically, or by using rotating beds of desiccant, a portion of which is always dehumidifying the air, while the remainder is being regenerated.

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Desiccant dehumidifiers provide maximum efficiency at low temperatures, and are able to maintain constant relative humidities even below 10%. A factor that should not be overlooked is that heat is added to the controlled atmosphere even though the unit is placed outside the storage room. The latent heat of vaporization of the moisture that is removed is converted to sensible heat. There is also a certain amount of residual heat left in the desiccant after reactivation which increases the air temperature.

Heat Removal

Since an excessive heat build-up will usually be experienced when either type dehumidifier is used alone to reduce the relative humidity in a seed storage room, let us consider several means of removing this heat. The most common and familiar method is by using a refrigeration-type air conditioner, which can also be used to "dehumidify." It operates in a manner similar to the refrigerant dehumidifiers except that it has a larger cooling coil area and provides air or water cooling of the condenser coils.

Technology used in controlled Seed godown

A controlled storage unit incorporates a refrigeration system to maintain the desired room environment for the commodities to be stored. A refrigeration system works on two principles:

1. Vapour absorption system (VAS), and
2. Vapour compression system (VCS)

VAS, although comparatively costlier, is quite economical in operation and adequately compensates the higher initial investment. Wherever possible such a system should be selected to conserve on energy and operational cost. However, it has its own limitations when temperature requirement is below 10°C and many of the fruits and vegetables except seeds, mango, etc. require lower than 10°C for long storage.

VCS is comparatively cheaper than VAS. There are three types of VCS systems available depending upon the cooling arrangements in the storage rooms i.e., diffuser type, bunker type and fin coil type. Diffuser type is comparatively costlier and is selected only when the storage room heights are low. The operational cost of such units is also higher. Bunker type is the cheapest and is preferred when storage room heights normally exceeds 11.5 m. Its operational cost is also low. Fin coil type, although about 5% costlier than the bunker type, is very energy

July

efficient with low operational cost and higher space availability for storage of produce. Such system is used for units with room heights of 5.4m onwards

In a refrigeration system, refrigerants are used to pick up heat by evaporation at a lower temperature and pressure from the storage space and give up the heat by condensation at a higher temperature and pressure in a condenser. Freon used to be a common refrigerant but as it causes environmental degradation, its use is going to be banned by the year 2008. Therefore, Ammonia is being increasingly used and preferred. Although several types of compressors and condensers are available, medium speed reciprocating compressors and atmospheric condensers are preferred because of the relatively lower cost, energy efficiency and ease in maintenance.

While selecting size of the equipment, care should be taken to assess all loads and proper provision should be made to take care of the peak demand during summer loading and aging of the equipment.

Heat load factors normally considered in a controlled Seed godown design are:

1. Wall, floor and ceiling heat gains due to conduction
2. Wall and ceiling heat gains from solar radiation
3. Load due to ingress of air by frequent door openings and during fresh air charge.
4. Product load from incoming goods
5. Heat of respiration from stored product
6. Heat from workers working in the room
7. Cooler fan load
8. Light load
9. Aging of equipment
10. Miscellaneous loads, if any