NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL SCIENCES OF UKRAINE

Agrobiological Faculty

Department of storage, processing and standardization of plant product after prof. B.V. Lesik

Workbook

to the subject: "Storage and processing technologies of crop products"
for the students' Training direction
"Agronomy"

Faculty _____
*Course*_____ *Group* _____
Name of student _____
_____
_____

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WORKBOOK

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Lab 1. The spot samples selection, forming united samples and average daily samples.

Task 1. Write down basic concepts of the standard "Rules of acceptance".

Quality -

Consignment of grain -

Spot sample of grain

United sample -

Average daily sample -

Average sample -

Sample -

Task 2. Indicate the order of grain reception in grain-collection enterprises.

Task 3. Point out the form order of the united samples for different consignments of grain.

Task 4. Write down order formation an average daily sample from a lorry.

Task 5. Write down term keeping of average sample of grain in laboratory.

Task 6. Make the acquaintance with the structure and work of different samplers and the device BIS-1.

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Lab 2. Determination of grain freshness

Task 1. The norms indexes of freshness of grain soft wheat according standards.

Task 2. Write down the methods determination of color, smell and taste of grain.

Task 3. Describe the possible changes of grain color.

Task 4. Describe the possible smells of grain and the reasons of their appearing.

Task 5. Describe the taste of the spoiled grain.

Date of performance _____

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Lab 3. The determination of grain infestation

Task 1. The standards norms of grain infestation by barn pests.

Task 2. Write down the methods determination of grain infestation by barn pests.

Task 3. Determine the grain infestation by barn pests:

a) Determine of grain infestation of cereals or pulses by barn pests in obvious form

Crops	Weight of grain sample, g	What pests are find, quantity	Degree of infestation, level	Is accept grain?

b) Determine grain infestation of cereals or pulses by barn pests in hidden form

Crops	Weight of grain sample, g	What pests are find, quantity	Level of infestation, %	Is accept grain?

c) Determine grain damages by corn-bug

Crops	Sample, g		Level of damaging	Is accept grain?
	total weight	weight of the damaged grain		

Write down signs of wheat damages by corn-bug.

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Lab 4. Determination of grain-unit by liter corn balance

Task 1. Indicate crops which standardized level of grain-unit depend on the destination.

Crops	Destination	Classes				
		1	2	3	4	5

Task 2. Indicate the meaning, definition about grain-unit and factors that affect it. Write down the method of grain-unit determination.

Task 3. Determine of grain-unit

Crops	Grain humidity according of standard, %	Actual humidity of grain, %	Weight of 1 litre of grain, g			Grain-unit with the correction on humidity, g/l	Class
			the 1th evaluation	the 2nd evaluation	middle evalu-ation		

Task 4. Write down how influence grain-unit on the grain price?

Date of performance _____

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Lab 5. The determination of grain humidity

Task 1. Write down norms of grain humidity for different crops.

Task 2. Indicate the methods determination of grain humidity.

Task 3. Write down definitions “critical” and “balance” humidity of grain. Grain division depends on the quantity of the humidity.

Task 4. Determine of grain humidity by a basic method.

Repeat-ability	Weight of box, g	Weight of grain before drying, g	Total weight of box with grain, g		Lost of weight, g	Humidity, %	Middle humidity, %
			before drying	after drying			

The percent of humidity (X) is calculated by a formula (separately to each sample):

$$X = (A \cdot 100) / B$$

where A – lost of weight, g (precision of analysis is 0.01);
B – weight of grain before drying, g.

Task 4. Determine of grain humidity by electrometric methods.

№	The name of hygrometer	Sample of grain, g	Counting out after scale of hygrometer	Humidity, %	Humidity with the correction on the temperature, %
1	2	4	5	6	7
1					
2					
3					
4					

Task 5. Describe methods determination humidity of corncob.

_____

_____

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Date of performance _____

The lab was checked by _____

Lab 6. The determination admixtures in grain

Task 1. Write down standard norms of foreign material, grain admixtures and harmful admixtures for grain of soft wheat, hard wheat, and barley.

Task 2. Describe methods determination of different types admixtures and order their analysis.

Task 3. Determine foreign material and grain admixtures in an average daily sample of grain.

a) Fill up table with indicates corresponding sieves depending on the crops.

№	Crops	Weight, g	Numbers of sieves			Time of sifting, min
			I Ø of sieve	II Ø of sieve	III Ø of sieve	

b) Determine foreign material and grain admixtures in an average daily sample of wheat and indicate particular fractions.

Weight of sample, g ___. Numbers of sieves: I ____ II _____ III _____

Fractions	**Content**	
	g	**%**
I. Grain admixtures		
1. broken grain		
2. thin grain		
3. squeezed grain		
4. sprout grain		
5. frost-shattered grain		
6. damaged grain		
7. insect bored damage grain		
8. unripe grain		
9. whole and damaged grains of rye, triticale and barley		
Total		
II. Foreign material		
1. mineral admixtures		
2. organic admixtures		
3. harmful admixtures		
4. fungus grains		
5. spoiled grain		
6. admixtures which pass through sieve with hole 1 mm		
7. spoiled grains of wheat, rye, triticale and barley		
Total		
III. Basic grain		
Total		

Task 4. Determine class of wheat grain according results of researches.

Grain admixtures, %	
Foreign material, %	
Class of wheat grain	

Date of performance _____
The lab was checked by _____

Lab 7. Determination of types and subtypes of grain

Task 1. Write down division of wheat grain on the types according of standard.

Task 2. Indicate division of grain difference crops on types and subtypes due to existing standards. Write down types and subtypes grains of rye, pea, maize, millet and rice.

Task 3.
a) Determine type of sample of wheat grain.

b) Determine type of sample of grain other crops.

Task 4. Determine the vitreous of wheat grain by diaphanoscope. Fill up the results into the table.

№	Vitreous grain		Semivitreous grain		Farinaceous grain	
	1st value	2nd value	1st value	2nd value	1st value	2nd value
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
All						

General vitreous grains, % = (∑ of vitreous grains + ∑1/2 of semivitreous)

Date of performance _____
The lab was checked by _____

Lab 8. The determination of quantity and quality of raw gluten in the wheat grain

Task 1. Indicate the norms of indexes of technological quality of grain of soft and hard wheat.

Name of index	Soft wheat, classes				Hard wheat, classes				
	1	2	3	4	1	2	3	4	5
Mass part of protein, %									
Mass part of gluten, %									
Deformation index of gluten (DIG)									
Group of quality									

Task 2. Conception about gluten of wheat grain.

Gluten (chemical composition):

Gluten quality (physical properties):

Factors affecting on quantity and quality of gluten:

Task 3. Determine quantity and quality of gluten in samples of wheat grain.

Sample	Quantity of raw gluten		Quality of gluten, units DIG	The group of gluten quality	Gluten description (colour)
	g	%			
Grain of good quality					
Grain damaged by drying					
Germinated grain					
Grain damaged by a harmful corn-bug					

Task 4. Determine the class of wheat grain according results of researches.

Task 5. Write down definitions of "strong" and "valuable" wheat.

Date of performance _____

The lab was checked by _____

Lab 9. The determination of autolytic activity of grain and flour by the falling number on the device of Hagberg-Perten

Task 1. Write down factors which influence on the autolytic activity of grain.

Task 2. To learn method determination of the falling number and work of the device Hagberg-Perten.

Task 3. To study the standard norms of falling number for the grains of wheat and rye.

Crops	Classes				
	1	2	3	4	5
Soft wheat					
Hard wheat					
Rye					

Task 4. To determine of the falling number in the grain and flour for different crops with different quality.

Sample	Falling number, sec.	Activity of λ - amylase	Grain class
The ground wheat of the normal quality			
The ground wheat of the germinated grain			
The ground rye of the normal quality			
The ground rye of the germinated grain			
The wheat flour of the normal quality			
The wheat flour of the germinated grain			

Characteristic λ - amylase activity depend on the number of falling.

Activity λ - amylase	**The falling number, sec.**	
	Wheat	**Rye**
High	<150	<80
Middle	200-250	80-250
Low	>300	>250

Task 5. To determine class of grain according results of analysis.

_____

_____

_____

_____

_____

_____

_____

_____

Date of performance _____

The lab was checked by _____

Lab 10. Active aeration of grain mass

Task 1. Write down functions of active aeration.

Task 2. Write down types installations for active aeration.

Task 3. Write down specific air supply for ventilation of the grain with different humidity.

Task 4. Determine expediency of grain mass ventilation by planchettes and nomograms.

Actual humidity of grain, %	Index of thermometer, °C		Absolute humidity, mm mercury column	Grain temperature, ^{0}C	Balance humidity, %	Conclusion
	dry	wet				

Task 5. Determine the duration of grain mass cooling if specific air supply _____ m^3/t per hour, grain temperature _____ºC, temperature of environment _____ºC.

Task 6. Determine the duration of drying consignment of wheat grain with weight _____ t from ____% till humidity 14% by fun with productivity ____ m^3/hour.

Date of performance _____
The lab was checked by _____

Lab 11. Technological calculation of the grain clearing

Task 1. Write down main ways of clarification and sorting of grain.

Task 2. Write down types of the grain clearing machines and their divided behind a structure of working bodies

Task 3. Write down kinds of grain cleaning

Task 3. Determine productivity of grain clearing machine which works with grain different crops

Calculation productivity clearing machines.

In the technical characteristics of the grain clearing machines their productivity expressed by 1-hour work machine with wheat grain which has 10 % foreign materials and humidity up to 16 %. If quantity foreign materials increase on the 1 % then productivity of machines declines on the 2 %, but if humidity increases on the 1 % – productivity declines on the 3 %.

If clearing machines work with other crops apply coefficient of equivalence (K). In this case passport productivity machine multiply on the K and K_1 (coefficient decreasing productivity machine which depend on the level humidity of grain and content foreign materials in it).

Actual productivity = passport productivity x K x K_1

Value coefficient of equivalence (K) for different crops

Crop	K	Crop	K
Wheat	1,0	Buckwheat	0,5
Rye	0,9	Rice	0,5
Barley	0,8	Pea	1,0
Oat	0,6	Lentil	0,6
Millet	0,3	Haricot	1,2
Maize	0,9	Seeds of grasses	0,2
Sunflowers	0,3	Seeds of vegetable crops	0,1

Coefficient decreasing productivity machine depend on the level humidity of grain and content foreign materials in it (K_1)

Humidity, %	**Content of foreign materials, %**			
	up to 10	**up to 15**	**up to 20**	**up to 25**
up to 16	1.0	0.9	0.8	0.7
17-18	0.9	0.81	0.72	0.63
19-20	0.8	0.72	0.64	0.56
21-22	0.7	0.63	0.56	0.49
23-24	0.6	0.54	0.48	0.42
25-26	0.55	0.49	0.44	0.39

Date of performance _____
The lab was checked by _____

Lab 12. Technological calculation of the grain drying

Task 1. Write down types of the grain dryers which do you know.

Task 2. Indicate factors which influence on the level temperature of grain drying.

Task 3. To calculate drying of food and seed grain

To dry _____ t grain with destination _____ from ____ till _____ % humidity. Model of grain dryer is _____.

1) to calculate productivity grain dryer in the plan units

(one plan unit equal 1 t dry grain if humidity decreased on the 6 %, for example from 20 till 14 %)

Actual productivity of grain dryer determines multiply plan productivity on the special coefficient which depends on crop (food grain of wheat, oat, barley and sunflower – 1; rye – 1.1; millet – 0.8; pea – 0.5; seed grain all crops – 0.5; buckwheat – 1.25; maize – 0.6; tare, lentil, rice – 0.3-0.4; bean, lupine, haricot – 0,1-0,2.

2) to calculate volume of works for grain drying in the plan units (this index determine by multiply physical weight of grain on the special coefficient which depends on changes grain humidity – Appendix 4).

3) to determine duration of grain drying in the hours of the grain consignment.

4) calculate lost of grain weight as result its drying by formula:

$$X = \frac{(W_1 - W_2) \times 100}{100 - W_2},$$

where X – lost of the grain weight, %;
W_1 – grain humidity up to drying, %;
W_2 – grain humidity after drying, %.

5) calculate grain weight after its drying by formula:

$$M_2 = \frac{(100 - W_1) \times M_1}{100 - W_2},$$

where M_1 – grain weight before drying, t;
M_2 – grain weight after drying, t;

Date of performance _____
The lab was checked by _____

Lab 13. Grain payments depending on its quality

Task 1. **To determine with using standard (Appendix 1) the class grain of the soft wheat. Consignment of grain has weight _____ t.**

Indexes quality	Results of analysis	Indexes quality according of standard which was established			
Humidity, %					
Foreign material, %					
Grain admixture, %					
Grain-unit, g /l					
Vitreous, %					
Quantity of gluten, %					
The quality of gluten, group					
Infestation by ticks, degree					
The number of falling, sec					

Price per 1 ton:

1 class _____ UAH;

2 class _____ UAH;

3 class _____ UAH;

4 class _____ UAH;

5 class _____ UAH;

6 class _____ UAH.

Payment for cleaning 1 т%_____ UAH;

Payment for drying 1 т%_____ UAH.

Task 2. To determine actual cost 1 t of grains depends on its quality:

a) acceptable weight

b) cost of acceptable weight

c) payment for grain cleaning

d) payment for grain drying

e) price discounts

f) price extra charge

g) actual cost of 1 t, UAH.

Date of performance _____

The lab was checked by _____

Lab 14. Quantitative-qualitative grain accounting during its storage

Task 1. To learn order counting weight of grain as a result changing humidity and foreign materials in the period post-harvest handling and storage.

a) Formula calculation lost of the grain weight as a result decrease humidity in the consignment:

$$X=\frac{100\times(a-b)}{100-b}, \quad (1)$$

where X – lost of the grain weigh, %;

a – humidity of the grain consignment before storage, %;

b – humidity of the grain consignment at the finish of storage, %.

b) Formula calculation increasing weight of the grain consignment as a result increasing its humidity:

$$X=\frac{100\times(b-a)}{100-b}, \quad (2)$$

where X – weight increasing, %;

a – humidity of the grain consignment before storage, %;

b – humidity of the grain consignment at the finish of storage, %.

c) Formula calculation decreasing weight of grain consignment as a result lost content of foreign materials:

$$X=\frac{(c-d)\times(100-e)}{100-d}, \quad (3)$$

where X – lost of the grain weigh, %;

c – quantity foreign materials of grain, which arrive, %;

d – quantity foreign materials of grain, which expenses, %;

e – grain lost as a result decreases humidity (calculated by formula 1), %.

Task 2. To learn norms of the natural losses of grains and seeds basic crops depend on the crop, way and term of storage.

If actual average (calculated) term of storage is over norms which indicate in the tabl. "Norms of the natural losses" (Appendix 3), therefore calculation lost of grain weight for this period carry out one of the ways:

At the average term of grain storage up to 3 mounts then norm of losses calculates by formula:

$$X = \frac{a \times b}{90}, \qquad (4)$$

where X – lost of the grain weigh, %;

a – rate of losses up to 3 months included, (according tabl. – Appendix 3), %;

b – average quantity days of storage, days;

90 – whole period of storage, days.

At the average term of grain storage more than 3 mount then norm of losses calculates by formula:

$$X = M + \frac{L \times K}{N}, \quad (5)$$

where X – lost of the grain weigh, %;

M – rate of lost for the previous period of storage, according to table (Appendix 3), %;

L – difference between the highest and lowest norms of natural losses for the intermediate term of storage, %;

K – difference between the average time storage of the grain consignment and time of storage determination for previous norms, months;

N – difference between the quantity months of storage that apply to difference between the norms of losses.

Task 3. Calculate quantitative-qualitative accounting of grain during its storage

Month	Incomings			Expenses			Monthly remains, t
	weight, t	humi-dity, %	foreign material, %	weight, t	humi-dity, %	foreign material, %	
August							
September							
October							
November							
December							
January							
February							
March							
April							
May							
June							
July							
August							
Total:							

I. Determination of average humidity of grain which Incomings:

Number of consignment	*Weight, t*	*Humidity, %*	*t %*

∑, t % =

Average humidity which incomings:

$$\frac{t_x\%}{Weight,t} = \_\_\_\_\_\%.$$

II. Determination of average humidity of grain which Expenses:

Number of consignment	*Weight, t*	*Humidity, %*	*t %*

∑, t % =

Average humidity which expenses:

$$\frac{tx\%}{Weight,t} = \_\_\_\_\_\%.$$

III. Determination of average foreign material of grain which Incomings:

Number of consignment	*Weight, t*	*Foreign materials, %*	*t %*

$\sum$, t % =

Average foreign material which incomings:

$$\frac{tx\%}{Weight,t} = \_\_\_\_\_\%.$$

Determination of average foreign material of grain which Expenses:

Number of consignment	*Weight, t*	*Foreign materials, %*	*t %*

$\sum$, t % =

Average foreign material which expenses:

$$\frac{tx\%}{Weight,t} = \_\_\_\_\_\%.$$

V. Lost of weight due to humidity changes:

$$X= \frac{100\times(a-b)}{(100-b)} \quad \textbf{(e)}$$

X= _____ =

VI. Lost of weight due to foreign material changes:

$$X=\frac{(c-d)\times(100-e)}{(100-d)} = \_\_\_\_\_ = \quad \%$$

X= t

Total weight, which we can be write off by the changes of humidity and foreign material:

X= t

VII. Calculate the average term of grain storage:

$$\textbf{\textit{Term storage}} = \frac{amount\ \ of\ \ mountly\ \ remains}{weight\ \ \ \ of\ \ grain\ \ which\ \ \ \ arrived}, \text{ months}$$

Term storage = ——————————— = months

VIII. Calculation of natural losses of grain during whole period of storage:

Norms of natural expenses X (%) determined by the formula:

$$X = M + \frac{L \times K}{N} = \quad + \text{————} = \quad \%$$

X= t

Date of performance _____

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Lab 15. Dislocation grains in the granary at the storage

Task 1. Indicate main principal's location of granary.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Task 2. Indicate principal's dislocation grains in the granary:

Task 3. With using grain-unit calculate capacity and area of granary for grain storage in the bulk. Formula for calculation capacity of granary: V=P/n; where P – weight of the grain consignment, n – weight 1 m^3 grain.

Crop	Weight of the grain, t (P)	Grain-unit, g/l	Weight 1 m^3 grain, t (n)	Height of bulk, m	Capacity of granary, m^3	Area of granary, m^2
Wheat						
Oat						
Barley						
Rye						
Triticale						

Task 4. Draw out schemes dislocation bags with grain in the stacks if they stack up:

- by twins

- by triplex

- ***by fifth***

Task 5. Indicate indexes grain quality which testing during its storage.

Date of performance _____
The lab was checked by _____

Lab 16. Estimation quality of the groats grain

Task 1. To Determine paleaceous, outputs and quality of groats:

a) to learn standard norms index quality content of kernel in the grain of the groats crops.

Buckwheat

Oat

Millet

Rice

b) to determine paleaceous of groats grain

Crop	Weight of the grain sample, g	Paleaceous, %	Outputs of groats, %
Buckwheat			
Oat			
Rice			

c) determine output and paleaceous of out

weight of sample, 5 g

Paleaceous:

Output:

Task 2. To estimate quality millet grain, results fill up in the table and compare them with norm of standard.

Indexes quality	Grade norms			Results analysis sample of grain
	High	I	II	
Color				
Taste				
Smell				
Humidity, %, does not more				
Kernel of good quality, %				
Mineral admixture, %				
Harmful admixture, %, does not more				
Damaged kernel, %, does not more				
Infection by barn pest, grade				
Unpeeled grain, % , does not more				

Task 3. Indicate another indexes quality of groats grain according norms of standard

Task 4. To learn norms of quality for another types of groats.

Date of performance _____
The lab was checked by _____

Lab 17. Determination output and quality of the wheat flour

Task 1. Calculate grinding mixes:

a) depend on quantity of gluten

b) depend on vitreous

Task 2. To learn norms of standard to the quality of flour different crops, grindings and outputs.

Task 3. Determine color, smell, taste and crunch in the two samples.

Sort of flour	Color				Taste	Crunch	Smell
	Dry sample		Wet sample				
	etalon	sample	etalon	sample			
First							
Highest							

Task 4. To determine infestation of flour by barn pest

_____

_____

_____

_____

Task 5. To determine fineness of grinding.

Sort of flour	According of standard				In the test sample			
	rest on sieve		pass through the sieve		rest on sieve		pass through the sieve	
	N	%	N	%	N	%	N	%
First-rate								
Highest								

Task 6. To determine titrated acidity of flour.

Sort of flour	Sample, g	Quantity of alkali that spend on titration, ml	Acidity of flour, grade
First-rate			
Shrot of wheat			

_____

_____

_____

_____

_____

Date of performance _____

The lab was checked by _____

Lab 18. Estimation quality of flour by method of laboratory trial baking

Task 1. To acquaintance with method of laboratory trial baking.

To weigh: 1. flour _____ I sort (dry substances) physical weight _____ g. 2. yeast suspension (yeast _____g, water _____ ml). 3. salt _____ g. 4. sugar _____ g.

5. total quantity of water according water absorption capacity _____ ml.

6. knead dough carry out with use dough mixer during _____ min.

Total quantity of dough _____ g.

Regime fermentation of dough:

1. temperature of fermentation _____º C, 2. humidity of air in the thermostat _____ %. 3. duration of the first fermentation _____ min.

Formation and proofing dough:

1. weight of dough _____g. 2. proofing dough in the thermostat _____ min. 3. temperature of the dough proofing ºC. 4. total duration of fermentation _____ min.

Bread baking:

1. temperature in the bakery chamber _____ ºC. 2. duration of baking: non-form bread _____ min, form bread _____ min.

_____

_____

_____

_____

_____

_____

_____

_____

Task 2. To acquaintance with standard on the bread.

_____

_____

_____

_____

_____

_____

_____

Task 3. To determine physical indexes quality of bread:

Indexes	According standard	Actual results
Volume yield of bread from 100 g of flour, ml		
Acidity, grades (º).		
Form-stable of bread		
Yield of bread (correlation between weight of bread to weight of flour)		

Task 4. Estimate organoleptic indexes quality of bread and fill up results to the table.

Indexes	According standard	Actual results
Appearance:		
a) surface		
crust colour		
form: form bread		
non-form		
b) state of crumb:		
porosity		
elasticity		
color of crumb		
taste		
smell		

Date of performance _____
The lab was checked by _____

Lab 19. Determination quality potato tubers

Task 1. To learn with using of standard methods selection samples of potato tubers.

Indicate: a) size sample of potato tubers

b) methods selection of potato tubers which transportation by boxes, containers and by bulk

c) to indicate weight potato tubers in the average sample

Task 2. Test potato tubers in the average sample

a) size of tuber potato

b) presents of the small tuber potatoes:

c) presents of potato tubers with mechanical damages:

d) presents of potato tubers which damages by different types of diseases:

Task 3. To determine dirty of potato tubers in the sample with using Parov balance.

Weight of potato sample _____ g.

Dirty according of scale _____ %.

To describe method determination dirty of potato tubers.

_____

_____

_____

_____

_____

_____

Task 4. To determine starch content of potato tubers.

1. by specific weight

Weight of potatoes, g	Volume water which was pressed, ml	Specific weight of potato tubers, g/ml	Content of dry substances, %	Content of starch, %

2. by Parov balance

Weight of potatoes, g	Temperature of water, °C	Correction on the water temperature, g	Starch content, %	
			by the scale	with correction on the water temperature

Task 5. Carry out sale of potato tubers depend on its quality.

Weight of potatoes _____t, price of 1 t potatoes _____ UAH
Dirty _____%.

Calculate acceptable weight of potato tubers:

Technical defect _____%, _____ t,
Dirty _____%, _____ t,
Acceptable weight = Physical weight – Dirty – Technical defect
_____ t,
nonstandard products _____ %, _____t,
Cost of nonstandard products _____ UAH,
Weight of standard production _____ t,
Cost of standard production _____UAH,
Total cost _____UAH.
Final cost 1 t of potatoes _____ UAH.

Date of performance _____
The lab was checked by _____

Lab 20. Storage of potatoes and vegetables in the temporary (field) storehouses

Task 1. To learn basic requirements to clamp area:
a) location relatively to sides of world, to living zone and etc.:

_____
_____
_____

b) indicate parts of clamp area

_____
_____
_____

c) indicate sizes of clamps and trenches depending on region of location

_____
_____
_____
_____

d) describe materials for coverage of clamps and trenches

_____
_____
_____
_____

Task 2. Calculate capacity and necessary quantity of the clamps, and trenches for storage:

Bulbs of potatoes_____ t

Bulbs of white-head cabbage _____ t
Root of carrots _____t
Root of beets _____t

Parameters of warehouse, m

Crops and type of warehouse	Length	Width	Depth	Height of bulk	Width of bulk	Ventilation, %	Mixing by sand, %
Clamps for potatoes							
Clamps for cabbages							
Trenches for carrots							
Trenches for beets							

Results of storages calculation

Crops and type of storage	Bulk density, kg/m^3	Capacity of warehouses, m^3		Capacity warehouses, t	Necessary warehouses, quantity
		total	pure		
Clamps for potatoes					
Clamps for cabbages					
Trenches for carrots					
Trenches for beets					

Tasks 3. Calculate the amount of earthwork (m^3) of digging trenches, grooves of clamps and production covering.

Task 4. Determine a quantity of straw for covering of clamps and tranches.

Task 5. Write down norms of natural losses for main types of vegetables at storage in conditions of cold zone.

Task 6. To calculate natural losses of plant production which storage from _____ till _____.

Type of warehouse	Type of production	Weight of production, t	Production was storage		Natural losses	
			from	till	%	t

Date of performance _____
The lab was checked by _____

Lab 21. Organization storage of fruits and vegetables

Task 1. To indicate regimes of storage different types of fruits and vegetables

Crops	Temperature, °C	Relative humidity, %	Regulated gas environment, %, (O_2, CO_2)

Task 2. To learn with inside and outside dimensions of the basic types of packages:

- boxes for apples
- boxes for tomatoes
- boxes for cucumbers
- container for watermelons
- container for apples

Task 3. Calculate the required area of the stationary warehouse (cold storage) for storage:

a) table beets in the cell store

b) carrots in the boxes

в) watermelons in the containers

Task 4. To indicate ways regulation parameters (temperature, relative humidity) of storage regimes fruits and vegetables.

a) in the standard cold storages

b) in the standard warehouses with active aeration

c) in the standard warehouses with natural ventilation

Date of performance _____
The lab was checked by _____

Lab 22. Production of the pickle cabbage

Task 1. To learn standard requirement on the pickle cabbage.

Task 2. To learn standard requirement on the fresh white cabbage and estimate quality of cabbage which use for pickling.

Indexes quality	Norm according standard	Quality of cabbage sample

Task 3. To learn requirement standard on the fresh beet carrot and estimate quality of carrots which use for pickling.

Indexes quality	Norm according standard	Quality of carrot sample

Task 4. Produce pickle cabbage

Weight cabbage for pickling, g			Carrot		Salt		Bay leaf		Weight of the pickle cabbage, %
before clearing	after clearing	% wastes	g	%	g	%	g	%	

Acidity, % of milk acid _____

_____

Task 5. To determine quality of the pickle cabbage:

a) volume of pickle cabbage (after free outflow of juice), % to total weight pickle cabbage with juice:

_____

_____

_____

b) organoleptic indexes:

/Indexes	According standard		Searching sample
	1	2	
Appearance			
Consistence			
Color			
Smell			
Taste			

Task 6. To determine physical and chemical indexes quality of pickle cabbage:

a) salt content

b) general acidity calculated on the milk acid

Date of performance _____
The lab was checked by _____

Lab 23. Estimation quality of the sugar beets technical purpose

Task 1. To learn order reception consignment of the sugar beets and selection sample of beets:

a) write down method estimation conditions of the sugar beets

b) with indication rules determination:

- beet dirty

- content of sugar

Task 2. To determine quality sample of sugar beets and results fill up in the table.

Indexes	Norm according of standard	Actual results
Physical state	Beets which do not lost turgor	
Presence of the boltering beets	1%	
Presence of the flabby beets	5%	
Presence of the beets with mechanical injures, %, do not more	12	
Presence of the green weight (% to the total weight), do not more	3	
Sugar content, %	Basic norm (established by sugar factory as average on the period five years)	
Presence flabbily and light dry beets	Do not admit	
Presence rotten, frost-shattered beets with glassy tissues	Do not admit	

Task 3. According to the evaluation results quality of sugar beets carries out payment sugar factory to growing enterprise for products.

Physical weight _____t.

Dirty of beets _____%.

Sugar content _____ %.

Cost of productions _____UAH

Task 4. To determine loss of weight and content of sugar after storage beets during 2 till 3 months.

Date of performance _____
The lab was checked by _____

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Appendixes

Appendix 1

The requirements for the grain of soft wheat

Indexes	The norms of classes for soft wheat			
	1	2	3	4
Grain-unit, g/l, no less than	775	750	730	Unlimited
Vitreous, %, no less than	50	40	Unlimited	Unlimited
Humidity, %, no more than	14,0	14,0	14,0	14,0
Grain admixture, %, no more than	5.0	8,0	8,0	15,0
Especially:				
the grain of cereals	3,0	4,0	4,0	Within the grain admixture
sprout grain	2,0	3,0	3,0	Within the grain admixture
Foreign impurity, %, no more than	1,0	2,0	2,0	3,0
Especially:				
mineral admixture	0,3	0,5	0,5	1
Especially:				
pebble, slag, ore	0,15	0,15	0,15	0,15
spoiled grain	0,3	0,5	0,5	1
Especially:				
fuzarious grain	0,3	0,5	0,5	1
harmful admixture	0,1	0,1	0,2	0,2
Especially:				
Smut and ergot (together)	0,05	0,05	0,05	0,1 (0,05 smut and 0.05 ergot)
Trichodesma incanum	Exclude			
cockle	Within the harmful admixture			
every of the sorts of other toxic grain	0,05	0,05	0,05	0,05
Smutty grain , %, no more than	8,0	8,0	8,0	10.0
Mass part of protein in re-calculation on dry substance, %, no less than	14,0	12,5	11,0	Unlimited
Mass part of row gluten, %, no less than	28,0	23,0	18,0	Unlimited
Quality of gluten: units of device VDK	45-100	45-100	45-100	Unlimited
The number of falling, sec, no less then	220	220	180	Unlimited

Appendix 2

The requirements for the grain of hard wheat

Indexes	The description and norm by classes for hard wheat				
	1	**2**	**3**	**4**	**5**
The grain of soft wheat, %, no less than	4	4	8	10	Unlimited
Grain - unit, g/l, no less than	750	750	730	710	Unlimited
Humidity, %, no more than	14.5	14.5	14.5	14.5	14.5
Vitreous, %, no less than	70	60	50	40	Unlimited
Grain admixture, %, no more than	5.0	5.0	8.0	10.0	15.0
Especially:					
sprout grain	1.0	1.0	3.0	3.0	Within the grain admixture
Foreign material, %, no more than	2.0	2.0	2.0	5.0	5.0
Especially:					
mineral admixture	0.3	0.3	0.5	0.5	1.0
Especially:					Within the mineral admixture
pebble, slag, ore	0.15	0.15	0.2	0.3	
spoiled grain	0.2	0.2	0.5	1.0	1.0
Especially:					
fuzarious grain	Within the spoiled grains				
harmful admixture	0.2	0.3	0.5	0.5	0.5
Especially:					
smut, ergot	0.05	0.05	0.1	0.1	0.1
Trichodesma incanum	Disallow				
cockle	Within the harmful admixture				
every of the sorts of other toxic grain	0.05	0.05	0.05	0.05	0.1
Smut grain, %, no more than	5.0	5.0	5.0	5.0	10.0
Mass part of protein in re-calculation on dry substance , %, no less than	15.0	14.0	12.0	11.0	Unlimited
The number of falling, sec, no less than	200	200	150	100	Unlimited

Appendix 3

Restrictive-control norms of natural losses of grain storage, %

Grain (seed) and its processed products	Term storage	In warehouses		In elevators	On adapted to storage sites
		bulk	in container		
Wheat, rye, barley, spelt	Up to 3 months.	0,07	0,04	0,05	0,12
	Up to 6 months.	0,09	0,06	0,07	0,16
	Up to 1 year	0,12	0,09	0,10	-
Oats	Up to 3 months	0,09	0,05	0,06	0,15
	Up to 6 months	0,13	0,07	0,08	0,20
	Up to 1 year	0,17	0,09	0,12	-
Buckwheat, rice	Up to 3 months	0,08	0,05	0,06	-
	Up to 6 months.	0,11	0,07	0,08	-
	Up to 1 year	0,15	0,10	0,12	-
Millet, Foxtail millet, sorghum	Up to 3 months	0,11	0,06	0,07	0,14
	Up to 6 months.	0,15	0,08	0,09	0,19
	Up to 1 year	0,19	0,10	0,14	-
Corn	Up to 3 months	0,13	0,07	0,08	0,18
	Up to 6 months.	0,17	0,10	0,12	0,22
	Up to 1 year	0,21	0,13	0,16	-
Cornbob	Up to 3 months	0,25	-	-	0,45
	Up to 6 months.	0,30	-	-	0,55
	Up to 1 year	0,45	-	-	0,70
Peas, lentils, bean, haricot bean, vetch, soybean	Up to 3 months	0,07	0,04	0,05	-
	Up to 6 months.	0,09	0,06	0,07	-
	Up to 1 year	0,12	0,08	0,10	-
Sunflower	Up to 3 months	0,20	0,12	0,14	0,24
	Up to 6 months.	0,25	0,15	0,18	0,30
	Up to 1 year	0,30	0,20	0,23	-
Other oilseeds	Up to 3 months.	0,10	0,08	-	-
	Up to 6 months.	0,13	0,11	-	-
	Up to 1 year	0,17	0,14	-	-
Cereals, including rice	Up to 3 months.	-	0,04	-	-
	Up to 6 months.	-	0,06	-	-
	Up to 1 year	-	0,09	-	-
Flour	Up to 3 months	-	0,05	-	-
	Up to 6 months.	-	0,07	-	-
	Up to 1 year	-	0,10	-	-
Bran and flour	Up to 3 months	0,20	0,12	-	-
	Up to 6 months.	0,25	0,16	-	-
	Up to 1 year	0,35	0,20	-	-

Appendix 4

Norms of natural losses of fruit and vegetable products and potato at the prolonged storage, %

Production	Type depository for storage of fruits	September	October	November	December	January	February	March	April	May	June	July	August
Cold Zone *													
Apples:													
autumn	Coolers	1.2	0.8	0.6	0.5	0.5	0.4	-	-	-	-	-	-
	Without the artificial cooling	2.0	1.2	1.2	1.0	1.0	-	-	-	-	-	-	-
winter	Coolers	1.0	0.4	0.3	0.3	0.25	0.25	0.3	0.3	0.3	0.5	-	-
	Without the artificial cooling	1.8	0.8	0.6	0.5	0.5	0.5	-	-	-	-	-	-
Pears	Coolers	1.0	0.8	0.6	0.6	0.5	0.4	0.4	0.4	0.5	-	-	-
	Without the artificial cooling	2.0	1.5	1.4	0.7	0.6	0.6	-	-	-	-	-	-
Grapes	Coolers	1.0	0.8	0.8	0.6	0.4	0.4	0.4	-	-	-	-	-
Cranberry	Warehouses and canopy	-	-	0.8	0.8	0.7	0.7	0.7	1.5	2.0	4.0	5.0	-
Cowberry	Warehouses and canopy	5.0	-	-	-	-	-	-	-	-	-	-	3.0
Warm Zone *													
Apples:													
autumn	Coolers	1.2	0.8	0.6	0.5	0.5	0.4	-	-	-	-	-	-
winter	«	1.0	0.4	0.3	0.3	0.25	0.25	0.3	0.3	0.5	0.5	-	-
Pears	«	1.0	0.8	0.6	0.6	0.5	0.4	0.4	0.4	0.4	-	-	-
Grapes	Warehouses without artificial cooling	1.5	1.2	1.2	0.9	0.8	0.8	-	-	-	-	-	-
	Coolers	1.0	0.8	0.8	0.6	0.4	0.4	0.4	-	-	-	-	-
Cranberry	Warehouses without artificial cooling	-	-	1.0	1.0	1.0	1.0	1.0	1.7	-	-	-	-

* The warm zone includes Crimea, Mykolaiv, Kherson, Odessa region, the cold - other regions of Ukraine.

Appendix 4. Continued

Production	Type of depository	September	October	November	December	January	February	March	April	May	June	July	August
Cold Zone *													
Beets, radish, rutabaga, kohlrabi, parsnip	With the artificial cooling	1,5	0,8	0,8	0,7	0,6	0,6	0,6	0,8	0,9	0,9	-	-
	Without the artificial cooling	1,7	0,9	0,8	0,7	0,6	0,6	0,6	0,8	1,1	1,9	-	-
	Clamps, trenches	1,5	1,0	0,7	0,6	0,2	0,3	0,6	0,9	2,0	-	-	-
Carrot, parsley, celery, turnip	With the artificial cooling	2,2	1,3	1,2	0,8	0,7	0,7	0,7	1,0	1,0	1,0	-	-
	Without the artificial cooling	2,3	2,0	1,3	0,8	0,7	0,8	1,0	1,2	1,4	-	-	-
	Clamps, trench with the mixing of sand	1,2	1,0	0,6	0,4	0,3	0,4	0,4	0,6	1,2	-	-	-
	Clamps, Trenches**	1,5	1,3	1,2	0,6	0,6	0,6	0,8	0,9	2,0	-	-	-
White cabbage, Red, Savoy, russels grades:													
Average maturity	Without the artificial cooling	-	3,3	2,4	1,1	2,5	2,7	-	-	-	-	-	-
	Clamps, trenches	-	3,3	1,8	1,0	2,0	2,5	-	-	-	-	-	-
Late maturity	With the artificial cooling	-	2,3	1,3	1,0	1,0	1,0	1,0	1,3	1,8	1,8	-	-
	Without the artificial cooling	-	2,8	2,1	1,0	1,0	1,2	1,3	1,5	-	-	-	-
	Clamps, trenches	-	2,8	1,8	0,8	0,8	0,8	1,1	1,3	-	-	-	-
Onion-Ripky and sample food	With the artificial cooling	0,8	0,7	0,6	0,5	0,5	0,5	0,6	0,8	1,1	1,2	1,5	1,5
	Without the artificial cooling	1,7	1,2	1,1	0,6	0,6	0,6	0,6	1,0	1,7	-	-	2,5
Garlic	With the artificial cooling	1,6	1,0	0,9	0,9	0,9	0,9	0,9	0,9	1,5	1,5	1,5	1,7
Pumpkins	Without the artificial cooling	3,0	2,0	1,2	1,1	1,1	1,2	1,3	1,5	-	-	-	-
	With the artificial cooling	1,5	1,2	0,7	0,5	0,3	-	-	-	-	-	-	-
Potato	Specialized store	1,4	1,2	0,8	0,6	0,5	0,5	0,5	0,9	1,1	-	-	-
	Clamps, trenches	1,4	1,0	0,7	0,4	0,4	0,4	0,7	0,9	1,5	-	-	-

Appendix 4. Continued

Warm Zone													
Beets, radish, rutabaga, kohlrabi, parsnip	With the artificial cooling	1,6	1,1	1,0	0,7	0,6	0,7	1,1	1,1	1,1	1,2	-	-
	Without the artificial cooling	2,0	1,3	1,0	0,7	0,6	0,7	1,2	1,8	1,9	2,0	-	-
	Clamps, trenches	-	1,5	1,3	0,7	0,5	0,6	0,7	2,3	2,5	-	-	-
Carrots, parsley, celery, turnip	With the artificial cooling	2,3	1,8	1,3	0,8	0,7	1,3	1,4	1,6	1,8	1,9	-	-
	Without the artificial cooling	2,5	2,2	1,3	0,8	0,7	1,3	1,6	2,3	2,5	-	-	-
White cabbage, Red, Savoy, Brussels grades:													
Average maturity	Without the artificial cooling	-	4,0	3,8	2,3	-	-	-	-	-	-	-	-
	Clamps, trenches	-	3,5	2,3	1,8	1,3	1,3	2,0	-	-	-	-	-
Late maturity	Without the artificial cooling	-	3,8	3,5	2,0	1,4	1,4	2,1	-	-	-	-	-
	Clamps, trenches	-	3,8	-	-	-	-	-	-	-	-	-	-
Onion-Ripky and sample food	With the artificial cooling	0,8	0,7	0,6	0,5	0,5	0,5	1,0	1,3	1,6	1,6	1,8	1,8
	Without the artificial cooling	2,0	1,5	1,3	0,7	0,6	0,7	1,1	1,6	2,0	-	-	3,0
Garlic	With the artificial cooling	1,9	1,7	1,2	1,0	1,0	1,0	1,0	1,0	1,7	1,7	1,7	2,0
	Without the artificial cooling	3,2	2,1	1,5	1,1	1,1	1,2	2,0	2,5	-	-	-	-
Pumpkins	With the artificial cooling	1,5	1,2	0,7	0,5	0,3	0,3	-	-	-	-	-	-

*In the cool zone the storage of products without artificial cooling set losses at specific norms are established for depositories with artificial cooling.

** When root crops are stored in the trenches and tabular heaps of mixed sand specific losses are not determined, with cold storage with controlled environment such losses are calculated using the rules of storage of cooled minus 15 %.

Appendix 5

Value of transfer coefficients volume of dried grain from physical tons to plan tons depending on initial humidity

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
11,5	10,0	0,86	16,0	11,0	1,20
13,5	10,0	1,13	16,0	11,5	1,07
13,0	10,0	1,10	16,5	12,0	1,01
13,5	10,5	1,03	16,0	12,0	0,96
13,0	10,5	0,93	16,5	12,5	0,92
13,5	11,0	0,86	16,0	12,5	0,85
13,0	11,0	0,79	16,5	13,0	0,80
13,5	11,5	0,73	16,0	13,0	0,74
13,0	11,5	0,62	16,5	13,5	0,70
14,5	12,0	0,57	16,0	13,5	0,62
14,5	10,0	1,27	16,5	14,0	0,60
14,0	10,0	1,20	16,0	14,5	0,52
14,5	10,5	1,13	16,5	14,5	0,50
14,0	10,5	1,07	16,0	14,0	0,42
14,5	11,0	1,00	17,0	11,0	1,31
14,0	11,0	0,95	17,5	11,5	1,24
14,5	11,5	0,88	17,0	11,5	1,20
14,0	11,5	0,80	17,5	12,0	1,13
14,5	12,0	0,75	17,0	12,0	1,08
14,0	12,0	0,68	17,5	12,5	1,03
14,5	12,5	0,59	17,0	12,5	0,97
14,0	12,5	0,54	17,5	13,0	0,93
14,5	13,0	0,51	17,0	13,0	0,87
15,5	10,0	1,39	17,5	13,5	0,84
15,0	10,0	1,34	17,0	13,5	0,76
15,5	10,5	1,27	17,5	14,0	0,73
15,0	10,5	1,17	17,0	14,0	0,67
15,5	11,0	1,12	17,5	14,5	0,64
15,0	11,0	1,07	17,0	14,5	057
15,5	11,5	1,01	17,5	15,0	0,55
15,0	11,5	0,95	17,0	15,0	0,49
15,5	12,0	0,89	17,5	15,5	0,47
15,0	12,0	0,82	17,0	15,5	0,38
15,5	12,5	0,78	18,0	12,0	1,17
15,0	12,5	0,70	18,5	12,5	1,12
15,5	13,0	0,66	18,0	12,5	1,08
15,0	13,0	0,60	18,5	13,0	1,05
15,5	13,5	0,57	18,,0	13,,0	1,00
15,0	13,5	0,47	18,5	13,5	0,96
16,0	10,0	1,46	18,0	13,5	0,83
16,5	10,5	1,37	18,5	14,0	0,86
16,0	10,5	1,31	18,0	14,0	0,80
16,5	11,0	1,27	18,5	14,5	0,78

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
18,0	14,5	0,70	20,5	18,5	0,39
18,5	15,0	0,68	21,0	13,0	1,24
18,5	15,5	0,59	21,5	13,5	1,22
18,0	15,5	0,53	21,0	13,5	1,17
18,5	16,0	0,46	21,5	14,0	1,15
18,0	16,0	0,46	21,0	14,0	1,10
18,5	16,5	0,44	21,5	14,5	1,08
18,0	16,5	0,35	21,0	14,5	1,03
19,0	13,0	1,08	21,0	15,5	0,92
19,5	13,5	1,05	21,5	16,0	0,91
19,0	13,5	1,00	21,0	16,0	0,85
19,5	14,0	0,97	21,5	16,5	0,84
19,0	14,0	0,92	21,0	16,5	0,77
19,5	14,5	0,89	21,5	17,0	0,76
19,0	14,5	0,84	21,0	17,0	0,69
19,5	15,0	0,80	21,5	17,5	0,68
19,0	15,0	0,74	21,0	17,5	0,60
19,5	15,5	0,73	21,5	18,0	0,59
19,0	15,5	0,66	21,0	18,0	0,52
19,5	16,0	0,64	22,0	13,0	1,34
19,0	16,0	0,57	22,5	13,5	1,31
19,5	16,5	0,56	22,0	13,5	1,27
19,0	16,5	0,49	22,5	14,0	1,27
19,5	17,0	0,46	22,0	14,0	1,20
19,0	17,0	0,42	22,5	14,5	1,17
19,5	17,5	0,42	22,0	14,5	1,13
20,0	13,0	1,15	22,5	15,0	1,12
20,5	13,5	1,12	22,0	15,0	1,08
20,0	13,5	1,08	22,5	15,5	1,07
20,5	14,0	1,00	22,0	15,5	1,01
20,5	14,5	0,99	22,5	16,0	1,00
20,0	14,5	0,93	22,0	16,0	0,96
20,5	16,5	0,70	22,5	16,5	0,95
20,0	16,5	0,62	22,,,0	16,5	0,89
20,5	17,0	0,61	22,5	17,0	0,88
20,0	17,0	0,54	22,0	17,0	0,86
20,5	17,5	0,53	22,5	17,5	0,82
20,0	17,5	0,47	22,0	17,5	0,75
20,5	18,0	0,43	22,5	18,0	0,74
20,0	18,0	0,41	22,0	18,0	0,68
20,5	15,0	0,93	22,0	19,0	0,51
20,0	15,0	0,87	23,0	13,0	0,49
20,0	15,5	0,86	23,5	13,5	1,46
20,5	15,5	0,79	23,0	13,5	1,43
20,5	16,0	0,78	23,5	14,0	1,39
20,0	16,0	0,70	23,0	14,0	1,31

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
23,5	14,5	1,29	25,5	17,0	1,20
23,0	14,5	1,24	25,0	17,0	1,13
23,5	15,0	1,22	25,5	17,5	1,12
23,5	15,0	1,17	25,5	18,5	0,99
23,5	15,5	1,15	25,0	18,5	0,95
23,0	15,5	1,12	25,5	19,0	0,93
23,5	16,0	1,10	25,0	19,0	0,89
23,0	16,0	1,05	25,5	19,5	0,88
23,5	16,5	1,03	25,0	19,5	0,84
23,0	16,5	0,99	25,5	20,0	0,82
23,5	17,0	0,97	25,0	20,0	0,78
23,0	17,0	0,93	26,5	20,5	0,77
23,5	17,5	0,92	25,0	20,5	0,70
23,0	17,5	0,87	26,5	20,5	0,70
23,5	18,0	0,86	25,0	21,0	0,64
23,0	18,0	0,80	25,5	21,5	0,63
23,5	18,5	0,80	25,0	21,5	0,54
23,0	18,5	0,74	26,0	16,0	1,39
23,5	19,0	0,73	26,5	16,5	1,37
24,5	17,0	1,08	26,0	16,5	1,34
24,0	17,0	1,01	26,5	17,0	1,31
24,5	17,5	1,00	26,0	17,0	1,27
24,0	17,5	0,96	26,5	17,5	1,24
24,5	18,0	0,96	26,0	17,5	1,17
24,0	18,0	0,91	26,5	18,0	1,17
24,5	18,5	0,89	26,0	18,0	1,13
24,0	18,5	0,86	26,0	18,5	1,12
24,5	19,0	0,85	26,0	18,5	1,05
24,0	19,0	0,80	26,5	19,0	1,05
24,5	19,5	0,79	26,0	19,0	0,99
24,0	19,5	0,72	26,5	19,5	0,97
24,5	20,0	0,71	26,0	19,5	0,93
24,0	20,0	0,65	26,5	20,0	0,93
24,5	20,5	0,64	26,0	20,0	0,88
24,0	20,5	0,56	26,5	20,5	0,87
24,5	21,0	0,56	26,0	20,5	0,82
24,0	21,0	0,49	26,5	21,0	0,82
24,5	21,5	0,48	26,0	21,0	0,77
24,0	21,5	0,42	26,5	21,5	0,76
25,0	15,0	1,43	26,0	21,5	0,69
25,5	15,0	1,40	26,0	22,0	0,62
25,0	15,5	1,34	26,5	22,5	0,62
25,5	16,0	1,34	26,0	22,5	0,54
25,0	16,0	1,28	27,0	17,0	1,39
25,5	16,5	1,24	27,5	17,5	1,37
25,0	16,5	1,20	27,0	17,5	1,31

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
27,5	18,0	1,29	29,0	20,0	1,24
27, 5	18,5	1,22	29,0	20,5	1,22
27,0	18,5	1,17	29,5	21,0	1,17
27,5	19,0	1,17	29,0	21,0	1,17
27,0	19,0	1,12	29,5	21,5	1,10
27 ,5	19,5	1,10	29,0	21,5	1,08
27,0	19,5	1,05	29,5	22,0	1,03
27 ,5	20,0	1,03	29,0	22,0	0,03
27,0	20,0	0,99	29,5	22,5	0,97
27,5	20,5	0,97	29,0	22,5	0,96
27,0	25,0	0,92	29,5	23,0	0,92
27,0	21,0	0,87	29,0	23,0	0,91
27,5	21,0	0,92	29,0	23,5	0,85
27 ,5	21,5	0,86	29,5	24,0	0,80
27,0	21,5	0,82	29,0	24,0	0,80
27,5	22,0	0,82	29,5	24,5	0,74
27,0	22,0	0,76	29,0	24,5	0,69
27 ,5	22,5	0,75	29,5	25,0	0,62
27,0	22,5	0,69	29,5	25,5	0,61
28,0	18,0	1,37	30,0	20,0	1,37
28 ,5	18,5	1,34	30,5	20,5	1,35
28,0	18,5	1,29	30,0	20,5	1,29
28,5	19,0	1,29	30,5	21,0	1,29
28,0	19,0	1,24	30,0	21,0	1,22
28 ,5	19,5	1,22	30,5	21,5	1,20
28,0	19,6	1,17	30,0	21,5	1,15
28,0	20,0	1,12	30,5	22,0	1,15
28 ,5	20,5	1,10	30,0	22,0	1,10
28,0	20,5	1,03	30,5	22,5	1,08
28 ,5	21,0	1,03	30,0	22,5	1,03
28,0	21,0	0,97	30,0	23,0	0,97
28,5	21,5	0,96	30,5	23,0	1,03
28,0	21,5	0,92	30,5	23,5	0,96
28 ,5	22,0	0,92	30,0	23,5	0,91
28,0	22,0	0,86	30,5	24,0	0,91
28 ,5	22,5	0,86	30,0	24,0	0,85
28,0	22,5	0,82	30,5	24,5	0,84
28,5	23,0	0,80	30,0	24,5	0,80
28,0	23,0	0,75	30,5	25,0	0,80
28 ,5	23,5	0 74	30,0	250	0,74
28,0	23,5	068	30,5	255	0,74
28 ,5	24,0	068	31,0	210	1,37
28,0	24,0	062	31,5	215	1,34
29,0	19,0	137	31,0	215	1,29
29,5	19,5	134	31,5	220	1,29
29,5	20,0	129	31,0	220	1,22
29,0	19,5	129	31,5	22 5	1,20

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
31,0	22,5	1,15	33,0	24,5	1,15
31,5	23,0	1,15	33,5	25,0	1,15
31,5	23,5	1,08	33,0	25,0	1,10
31,5	23,5	1,08	33,5	25,5	1,08
31,0	23,5	1,03	33,0	25,5	1,03
31,5	24,0	1,03	33,5	26,0	1,03
31,0	24,0	0,97	33,0	26,0	0,97
31,5	24,5	0,96	33,5	26,5	0,96
31,0	24,5	0,91	33,0	26,5	0,91
31,5	25,0	0,91	33,5	27,0	0,91
31,0	25,0	0,85	33,0	27,0	0,85
31,5	25,5	0,84	33,5	27,5	0,84
31,0	25,5	0,80	33,0	27,5	0,80
31,5	26,0	0,80	33,5	28,0	0,80
31,0	26,0	0,74	33,0	28,0	0,74
31,5	26,5	0,74	33,5	28,5	0,74
32,5	22,0	1,37	34,0	24,0	1,37
32,5	22,5	1,34	34,5	24,5	1,34
32,0	22,5	1,29	34,0	24,5	1,29
32,5	23,0	1,29	34,5	25,0	1,29
32,0	23,0	1,29	34,0	25,0	1,22
32,0	23,0	1,22	34,5	25,5	1,20
32,5	23,5	1,20	34,0	25,5	1,15
32,5	23,5	1,15	34,5	26,0	1,15
32,5	24,0	1,15	34,5	26,5	1,08
32,0	24,0	1,10	34,5	26,5	1,08
32,5	24,5	1,08	34,0	26,5	1,03
32,0	24,5	1,03	34,5	27,0	1,03
32,5	25,0	1,03	34,0	27,0	0,97
32,0	25,0	0,97	34,5	27,5	0,96
32,5	25,5	0,96	34,0	27,5	0,91
32,0	25,5	0,91	34,5	280	0,91
32,5	26,0	0,91	34,0	28,0	0,85
32,0	26,0	0,85	34,5	28,5	0,84
32,5	26,5	0,84	34,0	28,5	0,80
32,0	26,5	0,80	34,5	29,0	0,80
32,5	27,0	0,80	34,0	29,0	0,74
32,0	27,0	0,74	34,5	29,5	0,74
33,0	23,0	1,37	35,0	25,0	1,37
33,5	23,5	1,34	35,5	25,5	1,34
33,0	23,5	1,29	35,0	25,5	1,29
33,5	24,0	1,29	36,5	26,0	1,29
33,0	24,0	1,22	35,0	26,0	1,22
33,5	24,5	1,20	35,5	26,5	1,20

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
35,0	26,5	1,15	37,5	29,5	1,08
35,5	27,0	1,15	37,0	29,5	1,03
35,0	27,0	1,10	37,5	30,0	1,03
35,0	27,5	1,08	37,0	30,0	0,97
35,0	27,5	1,03	37,5	30,5	0,96
35,5	28,0	1,03	37,0	30,5	0,91
35,0	28,0	0,97	37,5	31,0	0,91
35,5	28,5	0,96	37,0	31,0	0,85
35,0	28,5	0,91	37,5	31,5	0,84
35,5	29,0	0,91	37,0	31,5	0,80
35,0	29,0	0,85	37,5	32,0	0,80
35,5	29,5	0,84	37,0	32,0	0,74
35,0	29,5	0,80	37,5	32,5	0,74
35,5	30,0	0,80	38,0	28,0	1,37
35,5	30,5	0,74	38,5	28,5	1,34
36,0	26,0	1,37	38,0	28,5	1,29
36,5	26,5	1,34	38,5	29,0	1,29
36,0	26,5	1,29	38,0	29,0	1,22
36,5	27,0	1,29	38,5	29,5	1,20
36,0	27,0	1,22	38,0	29,5	1,15
36,5	27,5	1,20	38,5	30,0	1,15
36,0	27,5	1,15	38,0	30,0	1,10
36,5	28,0	1,15	38,5	30,5	1,08
36,0	28,0	1,10	38,0	30,5	1,03
36,5	28,5	1,08	38,5	31,0	1,03
36,0	28,5	1,03	38,0	31,0	0,97
36,,5	29,0	1,03	38,5	31,5	0,96
36,0	29,0	0,97	38,0	31,5	0,91
36,5	29,5	0,96	38,5	32,0	0,91
36,0	29,5	0,91	38,0	32,0	0,85
36,5	30,0	0,91	38,5	32,5	0,84
36,0	30,0	0,85	38,0	32,5	0,80
36,5	30,5	0,84	38,5	33,0	0,80
36,0	30,5	0,80	38,0	33,0	0,74
36,5	31,0	0,80	38,5	33,5	0,74
36,0	31,0	0,74	39,0	29,0	1,37
36,5	31,5	0,74	39,5	29,5	1,34
37,0	27,0	1,37	39,0	29,5	1,29
37,5	27,5	1,34	39,5	30,0	1,22
37,0	27,5	1,29	39,0	30,0	1,20
37,5	28,0	1,29	39,5	30,5	1,20
37,0	28,0	1,22	39,0	30,5	1,,15
37,5	28,5	1,20	39,5	31,0	1,15
37,0	28,5	1,15	39,0	31,0	1,10
37,5	29,0	1,15	39,5	31,5	1,08
37,0	29,0	1,10	39,0	31,5	1,03

Appendix 5. Continued

Humidity of grain, %		Transfer coefficient	Humidity of grain, %		Transfer coefficient
before drying	after drying		before drying	after drying	
39,5	32,0	1,03	40,0	31,5	1,15
39,0	32,0	0,97	40,5	32,0	1,15
39,5	32,5	0,96	40,0	32,0	1,10
39,0	32,5	0,91	40,5	32,5	1,08
39,5	33,0	0,91	40,0	32,5	1,03
39,0	33,0	0,85	40,5	33,0	1,03
39,5	33,5	0,84	40,0	33,0	0,97
39,0	33,5	0.80	40,5	33,5	0,96
39,5	34,0	0,80	40,0	33,5	0,91
39,0	34,0	0,74	40,5	34,0	0,91
39,5	34,5	0,74	40,0	34,0	0,85
40,0	30,0	1,37	40,0	34,5	0,80
40,5	30,5	1,34	40,5	34,5	0,84
40,0	30,5	1,29	40,0	34,5	0,80
40,5	31,0	1,29	40,5	35,0	0,80
40,0	31,0	1,22	40,0	35,0	0,74
40,5	31,5	1,20	40,5	35,5	0,74

Appendix 6

Wheat. Grades and Grade Requirements according of USA standards

	Grades U.S. Nos.[1]				
Grading Factors	1	2	3	4	5
Minimum pound limits of:					
Test Weight					
Hard Red Spring wheat or White Club wheat (lbs/bu)	58.0	57.0	55.0	53.0	50.0
All other classes and subclasses (lbs/bu)	60.0	58.0	56.0	54.0	51.0
Maximum percent limits of:					
Defects					
Damaged kernel					
Heat (part of total)	0.2	0.2	0.5	1.0	3.0
Total	2.0	4.0	7.0	10.0	15.0
Foreign material	0.4	0.7	1.3	3.0	5.0
Shrunken and broken kernels	3.0	5.0	8.0	12.0	20.0
Total[1]	3.0	5.0	8.0	12.0	20.0
Wheat of other classes[2]					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total[3]	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
Maximum count limits of:					
Other material					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stone	3	3	3	3	3
Unknown foreign substance	3	3	3	3	3
Total[4]	4	4	4	4	4
Insect-damaged kernels in 100 grams	31	31	31	31	31

U.S. Sample Grade

Wheat that:

(a) Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, or 5; or

(b) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or

(c) Is heating or of distinctly low quality.

[1] Includes damaged kernels (total), foreign material, and shrunken and broken kernels.

[2] Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.

[3] Includes contrasting classes.

[4] Includes any combination of animal filth, castor beans, crotalaria seeds, glass, stones, or unknown foreign substance.

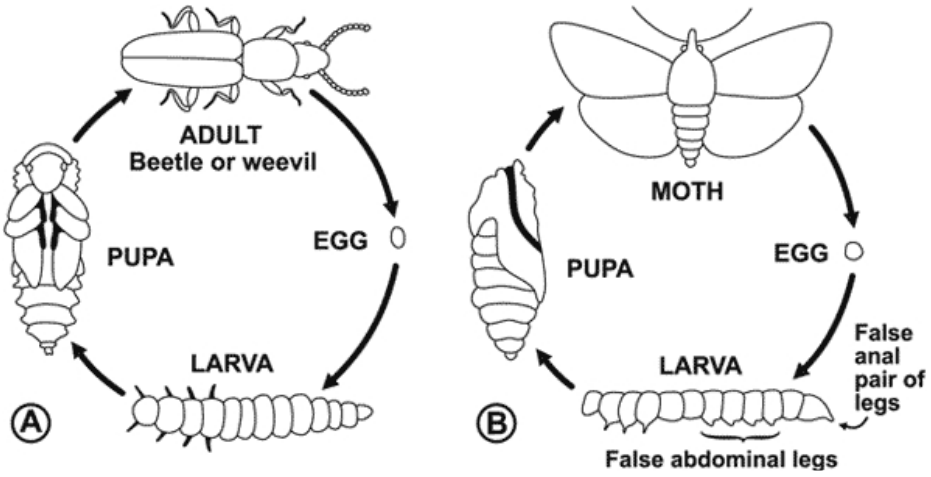


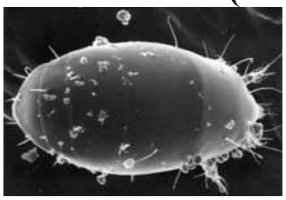
Fig. 1. Life cycles of stored-product insects: A, a beetle and B, a moth

A – The grain mite (left);

B – Warty grain mite (right);

C – Mould mite (left);

D – Longhaired mite (right);



E – Glossy grain mite female viewed from above (left);

F – Glossy grain mite female viewed from the side (right)

Fig. 2. Some major stored product mites as viewed by scanning electron microscope.

Appendix 8

Stored-product beetles

Common Name	Scientific Name	Adult colour	Adult length (mm)	Antennae	Can climb glass	Can fly
1	2	3	4	5	6	7
American black flour beetle	*Tribolium audax*	dark brown, black	3-4	clubbed	no	no
Cadelle	*Tenebroides mauritanicus*	Dark brown, black	6-10	clubbed	no	yes
Confused flour beetle	*Tribolium confusum*	reddish brown	2-4	clubbed	no	no
European black flour beetle	*Tribolium madens*	Dark brown, black	4-5	clubbed	no	yes
Flat grain beetle	*Cryptolestes pusillus*	reddish brown	2	thread	no	yes
Foreign grain beetle	*Ahasverus advena*	Brown	2	clubbed	yes	yes
Granary weevil	*Sitophilus granarius*	Dark brown, black	3-4	clubbed	yes	no
Hairy spider beetle	*Ptinus villiger*	Brown	2-4	thread	yes	no
Lesser grain borer	*Rhyzopertha dominca*	dark brown	2-3	clubbed	no	yes
Psocids	*Lepinotus reticulatus Liposcelis bostrychophilus*	light brown	1	thread	yes	yes
Red flour beetle	*Tribolium castaneum*	reddish brown	2-4	clubbed	no	yes
Rice weevil	*Sitophilus oryzae*	Dark brown, black	3-4	clubbed	yes	yes

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Appendix 9

Stored-product moths

Common Name	Scientific Name	Adult colour	Adult length (mm)	Antennae	Can climb glass	Can fly
1	*2*	3	4	5	6	7
Brown house moth	*Hofmannophila pseudospretella*	brown	8-11	thread	yes larvae	yes
Indianmeal moth	*Plodia interpunctella*	cream and brown	8-10	thread	yes larvae	yes
Meal moth	*Pyralis farinalis*	brown and tan	15-20	thread	yes larvae	yes
Mediterranean flour moth	*Ephestia kuehniella*	gray and black	10-15	thread	yes larvae	yes
Whiteshouldered house moth	*Endrosis sarcitrella*	white	8-11	thread	yes larvae	yes

Stored-product mites

Common Name	Scientific Name	Adult colour	Adult length (mm)	Antennae	Can climb glass	Can fly
cannibal mite	*Cheyletus eruditus*	white	0.4-0.6	-	yes	no
glossy grain mite	*Tarsonemus granarius*	orange, yellow	0.1-0.2	-	yes	no
grain mite	*Acarus siro*	white, tan	0.3-0.6	-	yes	no
longhaired mite	*Lepidoglyphus destructor*	white	0.3-0.5	-	yes	no
mould mite	*Tyrophagus putrescentiae*	white	0.3-0.5	-	yes	no

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