International Journal of Agriculture Innovations and Research
Volume 2, Issue 4, ISSN (Online) 2319-1473
Manuscript Processing Details (dd/mm/yyyy) :
Received : 23/12/2013 | Accepted on : 09/01/2014 | Published : 13/01/2014

Ventilation in Mini Farms

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Abstract - **Intensive production implies the accommodation of a large number of animals in a certain closed-up space. Those animals need to have secured optimal conditions for their growth, development and exploitation; and that is optimal temperature, air humidity and absence of harmful gasses: carbon dioxide, methane, ammoniac, sulphur hydrogen. In modern farms, both big and small ones, it is achieved through ventilation of an object. In our paper, we explained the most important elements of ventilation, the way of ventilation functioning, and through the examples for some kinds of domestic animals, we presented the possible ways of ventilation on small farms. As the examples, we introduced some charts of mini farms for keeping poultry, pigs, cows, sheep and goats.**

Keywords – **Ventilation, Mini Farms, Domestic Animals.**

I. Introduction

Economically successful agriculture, and within it livestock production as well, implies intensive breeding of different kinds of domestic animals. Intensive production implies accommodation of maximum allowed number of animals in one closed-up space, - barn, stable, pigsty, sheep-barn, etc. Primary purpose of such objects is to keep security and comfort of animals that are kept inside them. Proper accommodation of animals implies observing hygienic and zoo-technical standards, i.e. maintenance of microclimatic objects in optimal values.

Under microclimate we understand air pressure, noise, temperature, humidity and velocity of air circulation, sun's rays with light, ultraviolet and heat spectrum and heat rays. Among gasses, microclimate implies presence of certain concentrations: Oxygen (O_2), Ozone (O_3), carbon dioxide (CO_2), ammoniac (NH_3), sulphur hydrogen (H_2S), and among corpuscular air pollution, the presence of dust and microorganisms have been noticed [Hristov,S.2002]. Polluting agents of stable air are ammoniac, sulphur hydrogen, methane, carbon monoxide, smelly gasses – indol, squalene, mercaptane, etc.

In order to bring those microclimatic ingredients to an optimal level, the ventilation of an object seems to be necessary. Replacement of stable, non-purified air inside such objects by fresh, atmospheric air, is based upon starting movement of air mass, and such moving has to be carried out by optimal velocity (neither too slow, nor too fast). The best way would be if the air within one hour has been replaced several times, and during the summer time even more, especially with high temperatures.

The task of our research is to draw attention and propose solutions for maintaining microclimate, as one of the most important aspect of keeping and breeding domestic animals.

II. Literature Survey

Types of ventilation for big and small (mini) farms are the same, with the only difference in scope, due to the size of an object and number of animals within one object, i.e. needs for number of air changes during one hour.

Air change within objects for keeping animals may be performed by natural and artificial ventilation. Natural ventilation is based on difference in temperature between stable and external air pressure. That means that natural gravitational ventilation is based on moving temperature differences of air, i.e. as a result of air specific gravity ($V_2 = V_1 \times T_2/T_1$). (A. Nitovski, 2005).

Natural ventilation is supported by external air circulation as well. This way of ventilation functions in long, low objects, with regular arrangement of incoming and outgoing holes, and also with appropriate dimensions and the height of outgoing channel. In order to speed up air change on the principle of movement of air masses, incoming and outgoing ventilation channels have been built onto the side walls of stables. Incoming channels are built in the upper thirds of the walls, and may be round or square, located in equal spaces, along the entire length of the wall. At the entrance of those channels the closing caps are built in – regulators of air quantity which is found within the object. Incoming channels may be built in some other ways, i.e. above the ground, passing thus through the whole wall up to upper third, whereby the external air is being warmed before entering the stable [S. Hristov, S. 2002].

Incoming and outgoing ventilation channels that drain the polluted air out of the object, are started above the floor or bellow the ceiling, ending above the roof of the stable, functioning on the principle of temperature difference of external and internal air, so that the warmed internal air rises into higher layers towards the ceiling, i.e. through outgoing channels into outside.

This way of ventilation is recommended with small mini farms with small number of animals, for instance with about ten sows, about a hundred of fatteners, ten to twenty cows in feed.

In poultry industry, for maintenance and broiler and egg-laying hen breeding, a combination of natural and artificial ventilation is recommended for small farms, and for middle-sized ones (10 – 20 thousand of broilers, 10 – 20 thousand of egg-laying hens) an automatic artificial ventilation based on multi-air changes is recommended according to the concentrations of CO_2, air humidity and air temperature.

Artificial ventilation is based on application of ventilators on electric drive that mechanically perform initiation of air masses enabling air circulation. Those systems of ventilation function on principle of ventilator

application, which in stables may draw out non-purified air by creation of sub-pressure, inserting clean air by creating over-pressure and drawing and inserting the air by application of sub- and over- pressure simultaneously. [A. Lonuarović,1997].

Therefore, there are three systems of ventilation, as it follows:

- System for creation sub-pressure,
- System for creation of over-pressure,
- Combined system.

Needs for air changes in objects for keeping animals depend on size of the object, category and number of animals and a season.[Asay, A.1984].

Our proposal is that in small farms a combination of natural and artificial ventilation should be used, including use of windows, corresponding lids and shutters for air entering and axial (wall) ventilators for drawing the air out. In such way, sub-pressure is created by drawing the air out of the object, and vacuum thus appearing, is filled by fresh air coming in through the holes. The holes are located on the walls in their upper third in the middle of a roof, or across the roof with incoming channels. [A. Nitovski, 2005].

With middle-sized farms with larger number of animals (over 10000 broilers, more than 2000 egg-laying hens, etc.) a channel system of artificial ventilation is used.

With middle-sized farms for keeping pigs (over 100 of sows and over 1000 of fatteners), inserting of fresh air is achieved by ventilation devices that are performed on the principle of creation of over-pressure, whereby fresh or slightly warmed air in winter period is let into a plastic channel below the ceiling, and then according to the need is let into entire pigsty or only into some of its parts. [A. Lonuarović,1997].

With practical determination of the type of the ventilation way, we have to bear in mind the fact that it is necessary to secure simple, complete and permanent ventilation that will enable adequate ventilation during the whole year.

Ventilation systems for objects are different for every kind of cattle, whereby warming, velocity of ventilation and air distribution represent a base of good ventilation and maintaining of microclimate of an object. It is often anticipated the problem of air distribution within the closed object. The thing that is very important to be remembered is that with ventilation systems on the base of negative pressure, the air entrance is to be responsible for creation of scheme of air but not ventilators. (K. Bauml, 2002).

In larger objects or with various types of cattle, it is necessary to create different schemes of air in different periods during the year, for easier designing and setting ventilation systems.

For example, in hencoop, you want a good circulation with little draught during the winter. In summer it is the best to create light wind above the birds so that we could help them get cool. During the winter, it is necessary to let fresh, cold air over the grid space for defecation of that space, in order to prevent pigs from sleeping in there. During summer months, it is the best to let the air fall directly into the sleeping space, making such space the most suitable and comfortable for sleeping. (K. Bauml, 2002).

The air entrance, i.e. the average of incoming holes should be 0,7 cross-sections of outgoing channels.

The diameter of outgoing channels (B) is determined according to the formula:

$$B = O_v : V$$

B = diameter of outgoing channels, O_v = scope of ventilation, i.e. necessary air quantity for one animal during one hour, V = velocity of air circulation per hour.

For orientation in certain scopes of ventilation, there are ready made tables, according to which an easy determination of outgoing channels is possible. It is considered that dimensions should not be less than 35 x 35 cm and bigger than 100 x 100 cm. In narrow, outgoing channels the air might get too cooled, causing the stagnation of air circulation up to the condensation of a water vapour within the channel. It is more suitable to replace bigger channels by several smaller ones, of the dimensions about 70 x 70 cm, because bigger outgoing channels create strong air circulation, and air circulation in immediate vicinity of animals should not exceed 0,2 – 0,5 m/c.

Surface of incoming channels should be for 30-40% smaller than the surface of outgoing channels, because it has been assumed that so much air comes into a stable through the pores of walls, cracks, etc. In case of a larger diameter of incoming channels, the air within the stable may get too cooled in winter.

Average ventilation has been done on the base of number of air changes and differences in humidity in external air within the object, or on the base of the quantity CO_2 in external and internal air, i.e.:

$$V_{\text{of air}} = \frac{V\,CO_2}{K\,CO_{2(\text{inside})} - K\,CO_{2(\text{outside})}}$$

Whereby it is:

$V_{\text{of air}}$ – needed volume of air per kg of an animal per hour expressed in $m^3kg^{-1}h^{-1}$;

V CO_2 – volume of CO_2, which an animal excretes during 1 hour per unit mass ($m^3kg^{-1}h^{-1}$);

K $CO_{2\,(\text{inside})}$ – concentration of CO_2 in internal air;

K $CO2_{\,(\text{outside})}$ - concentration of CO_2 in external air (around 30 ppm);[Cris Bauml,2002].

According to the conditioned breed, i.e. breed of body weight 500 kg, the quantity of fresh air that should be let into a stable during one hour, amounts to 60 m^3. Depending on the type of an animal, growth and character of certain climatic areas, this may vary to a great extent , while in Central Europe it ranges within: for horses and cattle 58 – 71 m^3/h, for bred sows 49 – 55 m^3/h, for fattening hogs 61 – 71 m^3/h, for poultry 436 – 586 m^3/h.

In a stable of average size, air change should be carried out 4 – 4,5 during one hour in order to satisfy the needs of animals for fresh air. Needs for fresh air vary, depending upon many factors, making ventilation one of the most complex items that should be solved during the building of an object and setting up the technology of production.

For success of ventilation system, it is necessary to have in mind that none of them would provide an adequate

microclimate, unless enough attention is paid to elimination of sources, i.e. causes giving rise to pollution of stable air. That is why the attention has to be paid on maintenance of hygiene of an object (stable) and animal body. In that sense, the most important are regular elimination of excrements, window washing, thoroughly cleaning of barns, together with wall painting at least 2 times per year, both in autumn and in spring.

Whenever weather conditions make it possible, with ventilation on the base of sub-pressure with windows – the windows should be opened, and when all the animals are outside, all the windows and doors should be opened, so that the stable should be better dried and aired under the influence of sun's rays and draught,.

For more objective estimation of microclimatic conditions within the stable, constant measurement of temperature and relative humidity of stable air by thermometer and hygrometer is recommended.

III. Determination of Ventilator Capacity

Ventilator capacity in Anglo-Saxon countries is measured in cubic feet per minute (CFM) and should be used as the base when choosing ventilator. For securing optimal level of ventilation in a stable (barn, hencoop, pigsty), type, number and size of cattle or poultry that would be kept there, as well as general requirements for ventilation of animals may be taken into consideration. (K. Bauml, 2002).

Company Del Air System from Canada has its own general ventilation standards that are result of an acquired knowledge and experience on performing ventilation of closed objects for keeping animals in different climatic conditions of North America. We also used those standards in proposing the forms of ventilations for certain types of animals.

When determining the size and power of blowing ventilators, the attention, according to K. Bauml, 2002, should be paid to the following:

1. To determine the type, number and the size of animals that should be placed into an object,
2. To multiply the general rate (velocity) of ventilation, which is given in the table for that size and a type of animal you keep together with a number of animals that would be located into an object,
3. To check several times your results by calculation of ventilation requests through using the room:

$$\frac{L \times W \times H \times \text{necessary scope of ventilation } m^3 kg^{-1} h^{-1}}{60 \text{ minutes}} = \text{Requested feet of ventilation (CFM)}$$

L = length of object, W = width of object, H = height of object

Purpose of ventilators is to make air movement easier from stable towards outside. They do not control, or at least they do not need to control the air circulation inside the space (with exception of two-part stables).

Therefore, with narrow objects and narrow rooms with a good incoming air system, blowing ventilators can be located at any place, and still to be extremely efficient.

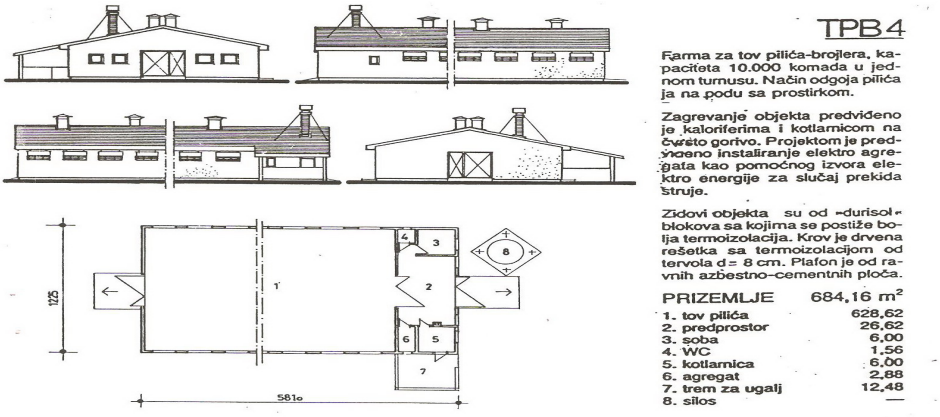
Installation of ventilators closer that 5 feet (1,5 m) should be avoided, as well as beside or bellow side air entrance in order to avoid re-inserting of air, expelled from the ventilator through the stable entrance. Installation of ventilators should be also avoided directly, the opposite of air entrance, at a distance less than 30 feet (9 m).

Ventilators for airing of rooms should be installed at such height, on which they are accessible for maintenance and cleaning.Ventilators may be grouped for easier connecting and maintenance; nevertheless, it is very important not to develop a high speed (frequency) of pressure before grouping. This can be avoided by grouping not more than three ventilators at one place.

In case of old-fashioned, two-part stables and other constructions that do not have any special air entr ance, fresh air flows in through fissures, cracks and other places where the air may go thorugh. In this case, the size of ventilators should be small with more units placed within the scope (along the periphery) of the stable. Quite often, the units for internal circulation of air are needed (ventilators and/or pipes for air flow), so that the air could adequately circulate through the room.

IV. Discussion and Analysis of Paper

Ventilation in Hencoop



TPB 4 (fattening of broilers)

International Journal of Agriculture Innovations and Research
Volume 2, Issue 4, ISSN (Online) 2319-1473

Farm for fattening of chickens – broilers, capacity of 10.000 pcs. in one shift. The way of breeding chickens are on the floor with a cover.

Heating of the object is anticipated by heaters and boiler-room on solid fuel. The project included the installation of an electro-aggregate, as an auxiliary source of electric power in case of electricity interruption.

The walls of the object are made of –durasol- blocks, which provide better thermo-insulation.

The roof is a wooden grid with thermo-insulation of tervol – d = 8 cm. The ceiling is made of flat, asbestos and concrete plates.

GROUND FLOOR		684,16 m^2
1.	Fattening of chickens	628,62
2.	Pre-space	26,62
3.	Room	6,00
4.	WC	1,56
5.	Boiler-room	6,00
6.	Aggregate	2,8
7.	Space for coa	
8.	Silo	___

By ventilation, the water evaporation made by chickens, is eliminated, contributing thus to the quality of the base. Ventilation maintains regular level of oxygen, eliminating carbon dioxide and ammoniac. During the first two weeks, ventilation has to provide fresh air minimum 0,7 m^3/h per kg of live weight, in order to eliminate evaporation and CP_2, made by chickens and artificial hens.

After two weeks, ventilation is regulated in such way to maintain a good environment and proper humidity.

In cages, since the risk from dehydration is bigger, a good control of humidity is necessary, and in case of need, the floors should be wetted.

The task of ventilation in hencoops with egg-laying hens and broilers is to regulate temperature within object, air humidity and level of gasses, such as CO_2 and NH_3. Ventilation should function even when ambient temperature does not cause the switching the ventilation on.

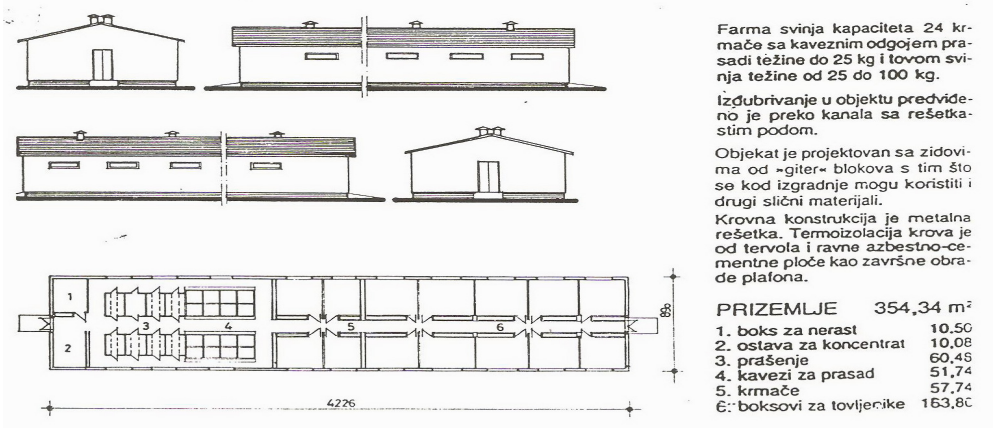
In smaller objects, during first two weeks it is important that one of the ventilators is being timely controlled in reference to the clock. That ventilator should work 10 minutes within an hour, enabling so the elimination of poisonous gasses and enrichment by oxygen. Ventilators should be capacity of 3,7 m^3/h for every kg of live weight. Sprayers for additional cooling are necessary, when the humidity within the object is low.

Velocity of air circulation is also important in the object. Every increase of velocity of air circulation for 0,1 m/sec. may cause the decrease in temperature from 1 – 1,5^{0}C. Ventilation system should be kept clean. Dust on ventilators and ventilation systems may reduce the efficacy of ventilation even to 30%, while the air humidity should be maintained in the values between 55-60% during the first 3 weeks and it may even go up to 60-70% during fattening. It is important that the cover be maintained in good condition without much humidity, which will reduce the level of ammoniac (NH_3).

On floor keeping at 1m^2 about 60 egg-laying hens are kept. In a cage there are 5 egg-laying hens. The cages are arranged on 3 storeys. Batteries are placed on the distance from the wall at 0,8 – 1m. For two batteries, the width of an object is about 6 m. For 2000 of hens, for instance, the length of an object is 20 m.

Distance between batteries is 1,20 – 1,40 m.

Ventilation in pigsties



Farm of pigs, capacity of 24 sows with cage breeding of pigs – weight up to 25 kg and fattening of pigs from 25 to 100 kg of weight.

Dismanuring within the object is anticipated through the channel with grid floor.

The object is designed with walls of “giter” blocks, but also other similar materials may be used.

The roof construction is a metal grid. Thermo-insulation of a roof is made of tervol and flat, asbestos and concrete plates as finishing processing of a ceiling.

Ground Floor	354,34 m^2
1. Box for boar	10,50
2. Chamber for concentrate	10,08
3. Farrowing	60,48
4. Cages for pigs	51,74
5. Sows	57,74
6. Boxes for fatteners	163,80

Mini farms for keeping pigs (pigsties) are the most frequently built separately for reproductive breeding herd and fattening. In our conditions of keeping sows, there are

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Volume 2, Issue 4, ISSN (Online) 2319-1473

usually 10, 20 up to 50 sows. Middle-sized farms are with 100 to 200 sows. Mini farms for fattening are mostly often built for fattening from 200 to 500 fatteners. (A. Nitovski, 2005).

Quantity of fresh air for 500 kg of pigs' mass is for bred sows 49-55 m^3/h, and for fattening hogs 61-71m^3/h.

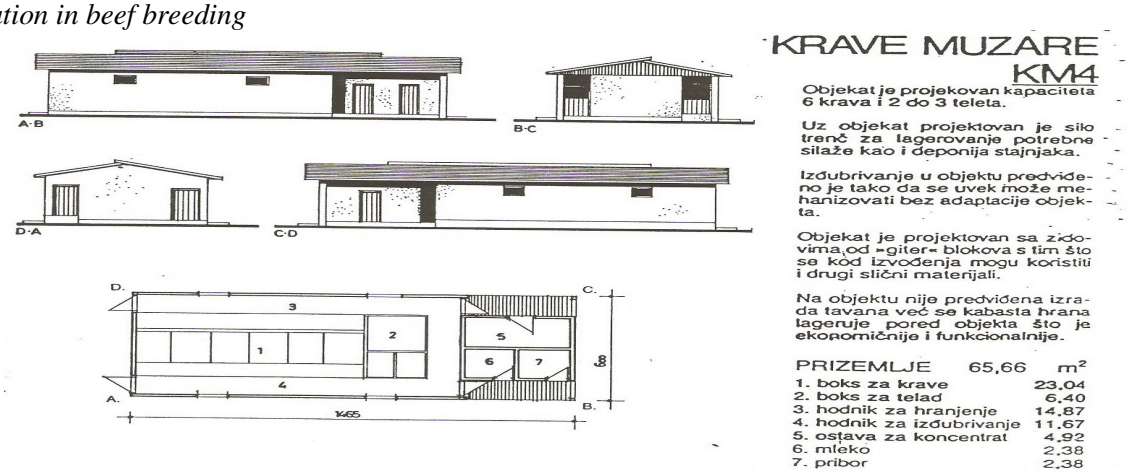
Kind of animal	During the whole year	In winter time
Fattening hogs	1,2-1,5	0,5
Breeding pigs	1,5-1,7	0,5

In fattening box, 10-12 fatteners are put into one box, while in pre-fattening box up to 20 fatteners. For one breed in pre-fattening box, 0,30 m^2 should be provided on a litter site, i.e. 0,40 m^2 of the entire box per pig. In finishing fattening box, surface per fattener should be 0,60 – 0,70 m^2 of floor surface, while the combination of full solid floor on which animals lie and grid one is recommended, where the feeding bottles and the channel for dismanuring are placed. Ventilation regulates a certain temperature and air humidity, eliminating poisonous gasses at the same time. (A. Nitovski, 1986).

Modern objects have an automatic ventilation with thermo regulators and heaters, enabling thus an automatic regulation of temperature in summer or winter months. The most frequently applied ventilation is that one with sub-pressure (Del-Air Systems), wherefrom the air is drawn out of the object (room) by axial ventilators of certain power, and on its place fresh air is inserted through the holes and incoming channels on the opposite wall. The lids are usually placed under the ceiling or the air is inserted by incoming channel into the space between the roof and grid-like ceiling, where the inserted fresh air is warmed and so warmed, it goes down through the holes of ceiling (perforated plastics) onto pigs. Drawing air from the object is carried out through ventilators or through outgoing channels starting over the animals and ending up above the top of the roof in the height of at least 1 m above the roof. It is recommended that the height of outgoing channel be not less than 3m (A. Nitovski, 2005). Automatic switching the ventilators on is most frequently connected with thermo regulators or hygrometers. There are also systems where the indicators for switching the ventilators on are concentrations of CO_2 and NH_3.

A certain system of ventilation is built in depending on the way of keeping, intensity and a level of object exploitation, technical and technological possibilities and invested means.

Ventilation in beef breeding



MILKING COWS KM4

The object is designed with a capacity of 6 cows and 2 to 3 of calves.

Together with the object, a trench is planned for storing necessary quantity of silage, as well as disposal of stable manure.

Dismanuring is carried in such way that it can be always mechanized without the adaptation of object.

The object is designed with walls of –giter blocks, using also other similar material during building it.

The ceiling was not anticipated to be built in the object, but roughage is stored beside the object, which is more economic and functional.

Ground Floor	65,66 m^2
1. Box for cows	23,04
2. Box for calves	6,40
3. Corridor for feeding	14,87
4. Corridor for dismanuring	11,67
5. Chamber for concentrate	4,92
6. Milk	2,38
7. Accessory	2,38

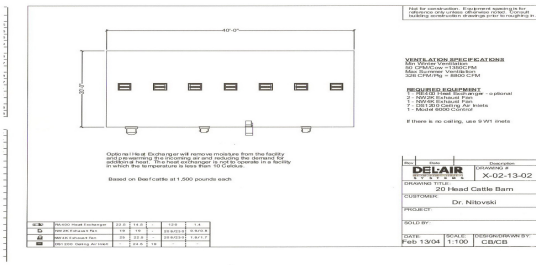
Size of the optimal milky farm depends on several factors: production goal, genotype of cattle, available agricultural surface for production of cows, compliance with eco-system, keeping natural equilibrium.

Austria has 10,3 milking cows per a farm, while Great Britain has 86,8 milking cows. According to Austrian and German studies, one complete production unit (breeding stock, fattening of bullocks up to final mass of 400 to 500 kg is above 40 milking cows.

During fattening of bullocks and heifers, there are two ways of keeping animals: free holding in boxes with grid-like work and binding way of keeping them in a box for free holding; the surface for one beef breed is 2 m^2, and about 10-15 cows are placed in one box.

With floor keeping, calves and cows are kept on full, solid floor with little straw that is put in the morning. Hay

racks are turned towards the wall. Drinking is water through. The food that is given may be silaged, dry, roughage and concentrated food.



During fattening, 7 kg of food is given for 1kg of weight gain, and fattening itself lasts 6-7 months.

Stables for milking cows should enable appropriate accommodation of cows and their breeding stock with favourable microclimatic and other conditions, providing proper welfare, nutrition, milking and elimination of excrements.

Cattle are the type of animals that are much more resistant to unfavourable climatic conditions than the rest of domestic animals, and so their keeping does not require large material investments. There are free (lauf system) and binding way of keeping.

Cattle may endure a big temperature range (from 10-20^{0}C). It is regarded that the acceptable air humidity is between 50 and 75% for milking cows. Beside temperature and air humidity, ventilation also regulates the content of oxygen, concentration of poisonous gasses in the air, etc.

With calculation of scope and intensity of ventilation in the objects for cows, it is necessary to take into consideration the following indicators (for a cow of body mass 500 kg): water evaporation per beef breed 450 g/h, CO_2 – 165 l/h, and heat production 4318 KJ/h.

Kind of animal	During the whole year	In winter time
Cattle	0,6-0,8	0,4
Fattening calves	0,8-1,1	0,3

It is recommended that the velocity of ventilation per body mass of a cow with 454 kg is 2,8m^3 per minute.

In stable air, beside the oxygen, nitrogen and carbon dioxide, there are other poisonous gasses present, originating from metabolic processes of ruminants and fermentation of waste. Those gasses belong to a group of gasses that irritate a mucous membrane of respiratory tract and eyes. Those are NH_3, H_2S, indol, scatol, etc. Allowed concentrations of NH_3, are from 10-20 ppm, CO_2 – 3000 ppm and H_2S – 0,5-5,0 ppm.

When choosing an appropriate accommodation for cattle, the attention should be paid to the following: animal, production and technical, ecological and economic indicators, as well as the indicators of work process.

The accommodation is suitable if the indicators of immunity, endocrine and biochemical profile are found within optimal frames. Hygienic measures have to be planned before starting construction in order to make the maintenance simpler later. Pathological indicators (injuries, miscarriages, deaths) point out to the disorder in accommodating stable spaces.

It is necessary to satisfy the needs of cattle for movement, rest, intake of water and food, secure undisturbed milking, and satisfy special needs for undisturbed fattening.

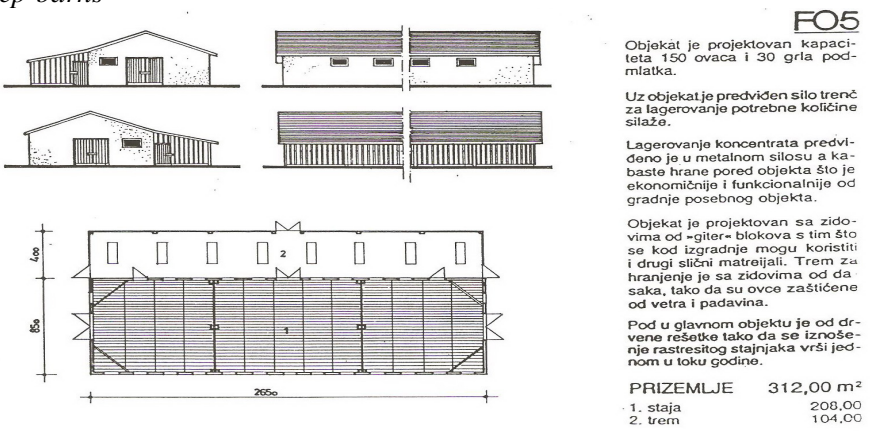
Stables for free keeping of milky cows:

In designing stables for milky cows it is necessary:

- To lay the buildings into favourable position, with regard to the wind, sunshine, and land configuration,
- To shadow the exposed parts of a stable or light additionally the darker parts, and create the best way of ventilation, but excluding draughts.
- Protect the cattle from falls.

Stables for binding way of keeping cattle imply that cattle are fixed in a binding way to the edge of hay racks (waves) by one of the ways of binding in one or two rows. Binding way of keeping is represented mostly on farms with a small number of cows (up to 20 cows). Disadvantages, as silent chasing, frequent injuries of legs and other parts of body, bad social contact of breeds, often womb prolapses, etc., point out to high level of stress that cattle experience when kept this way. There is a short litter site of a length of 150-170 cm and medium long litter site with a length of 230 cm, and width between 145 and 170 cm. Behind such litter sites, it is necessary to provide space for milking, dismanuring and other activities of at least 2 m.

Ventilation in sheep-barns



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The object is designed with a capacity of 150 of sheep and 30 of breeding stock.

Together with the object, a trench is planned for storing necessary quantity of silage.

Storing of concentrate is anticipated in a metal silo and roughage right beside the object due to more economic and functional reasons than building a new object.

The object is designed with walls of –giter blocks, using also other similar material during building it. Feeding-box is made with wooden walls, so that the sheep are protected from wind and falls.

The floor in main object is made of wooden grid so that the taking out of loose stable manure is done once a year.

Ground Floor	312,00 m^2
1. Barn	208,00
2. Feeding-place	104,00

Ventilation in objects for sheep and goat accommodation should provide optimal conditions for life, growth and development of breeding stock and grown up goats and sheep. The air humidity should be between 50 and 80%, and a temperature of air for grown up goats and sheep should be between 8 and 18^0C. Velocity of air circulation should be about 0,1 m/sec.

Concentration CO_2 in stable air should not exceed 3500 ppm, concentration NH_3 – 30 ppm, and H_2S – 5 ppm. Regular ventilation is achieved by establishing the corresponding relationship between number of sheep and goats according to the surface, i.e. volume of the object, scope of ventilation and number of air changes within time unit. It can be realized by placing the corresponding number of incoming and outgoing holes for ventilation, their regular schedule and size. Thus, the question of ventilation within the objects for keeping sheep and goats may be quite well and efficiently solved through natural ventilation. Artificial ventilation is especially important during winter conditions, when more quantity of fresh air should be reached (12 m^3/h) per grown up breed of those types. Also, the air with higher percent of humidity and poisonous gasses should be eliminated from the stable, taking care not to increase the air circulation above the allowed limit (0,2 m/sec).

The height of an object for sheep and goats ranges from 2,7 to 3,0 m, depending on the type, construction and the type of litter site. The width of the sheep and goats stable with deep cover usually amounts from 8 to 10 m, while the length depends on the number of sheep and goats.

With smaller herds, size of 200 to 300 sheep and goats, one mutual object is usually used for accommodation of all categories. Its internal space is divided by the system of gates for the needs of individual categories of sheep, that is, goats [Hristov,S.2002].

V. Conclusion

1. For successful, intensive and successful production, the adequate accommodation of animals should be provided.
2. The accommodation of animals next to corresponding object that is suitable according to the type and number of animals in accordance with appropriate regulations implies the adequate ventilation of the object as well.
3. Ventilations secures optimal temperature, air humidity, minimal air circulation and minimal concentration of poisonous gasses (CO_2, NH_3, H_2S, CH_4).
4. Ventilation in mini farms may be natural and artificial. In small objects with small number of animals, adequate and efficient ventilation can be provided with a good arrangement of incoming and outgoing pipes and holes.
5. Our recommendation is that ventilation based on sub-pressure is used within mini farms, whereby axial (wall – upright ventilators) placed on the wall of one side of the object draw out the air from the object, letting fresh air come in through the lids, shutters or incoming holes on the opposite side of the object.
6. Natural ventilation is not enough for intensive breeding and keeping animals, and thus the artificial ventilation is used, which should be automatic and bound to some of elements of maintenance of natural microclimate, such as, for instance, temperature, air humidity, etc.

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