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INFLUENCE OF DIFFERENT VENTILATION SYSTEMS ON INHALABLE AND RESPIRABLE DUST PARTICLES CONCENTRATIONS DISTRIBUTION IN WEANING AND FINISHING FATTENING PIG HOUSES

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Abstract: The application of different mechanical extraction ventilation systems in reducing and controlling dust concentrations in weaned and finishing pig houses was analyzed and discussed in this work.

Dust concentrations and airflow velocities have been measured at 20 measuring points, smoothly positioned over the house cross section, in the net consisting of 4 horizontal and 5 vertical rows. The lowest horizontal row was positioned at the pigs breathing zone (40 cm above the floor), and the highest (fourth) horizontal row was positioned at the workers breathing zone (160 cm). Control values were measured in houses with closed doors and windows and all the fans switched off. These values were compared with three experimental sets of values achieved with: floor, roof and both ventilation systems.

Dust concentrations were measured by konimeter (Konimeter 10, Karl Zeiss, Jena), airflow velocity in ventilation ducts with a turbine anemometer and the airflow velocity at measuring points with hot wire anemometer.

In the finishing house significant decrement of inhalable ($F = 44.35$, $P \ll 0.01$) and respirable ($F = 43.82$, $P \ll 0.01$) dust concentration was achieved in the third experimental treatment. In the weaned piglets house, significant decrement of inhalable ($F = 49.43$, $P \ll 0.01$) and respirable ($F = 42.69$, $P \ll 0.01$) dust concentration was achieved with floor ventilation.

Key words: weaning pigs, finishing fattening pigs, inhalable dust, respirable dust, concentration, konimeter, ventilation system, airflow velocity.

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Introduction

The control of primary dust production, concentration and sedimentation as well as its secondary production in swine confinement buildings is very difficult. For that reason, the issue of dust concentration and size distribution control, along with the maintenance of other microclimate conditions within optimal intervals remains open.

This work is an attempt to experimentally research and analyze one possible approach to solving this problem, based on supposed dependency of dust concentrations field on airflow velocities field in weaned piglets and finishing fattening pigs houses.

Proofs of harmful effects of polluted emissions from livestock buildings to humans and animals health have been collected and supplemented over the last 10-15 years (Wathes, 1994). One of the first researchers in this field, Donham (1999), noticed a growing interest of a large number of authors in this field, especially from the beginning of the 1980s until today. Their fields of interest are very different: dust production, types and characteristics, concentration and dimensions measurement, concentrations threshold limits and standards, influence of dust on human and animal health, environmental pollution, designing of dust concentrations distributions models and dust concentration reduction.

The importance of researches on dust in livestock buildings can be better realized if the most harmful effects are emphasized:

– Dust mechanically irritates the skin and mucous of respiratory organs and disturbs the immune status of human or animal organism (Ostro and Chestnut, 1998).

– Dust is the most important vector of pathogen and non-pathogen microorganism colonies (Takai et al., 1993; Donham, 1991.).

– Dust absorbs and transfers gases, odors and vapors (DeBoer et al. 1991).

– All the mentioned effects have similar consequences for workers in and around the livestock buildings too (Zeida et al., 1993; Dosman et al., 1988; Donham et al., 1984).

– Adverse effects of dust on the equipment (ventilators, electromotors, ventilation ducts and canals, air filters, heat exchangers etc.) in livestock confinements were also proved (Maghirang et al., 1995; Carpenter, 1986).

Finally, humans consume even 15 kg of air (daily average) but only about 1 kg of food and 1.5 kg of water. At the same time, finishing fattening pig consumes about 40 kg of air, 2.5 kg of food and 4 kg of water (Zhang, 1999).

Dust concentration may be reduced by: air filtration (Carpenter, 1987; Carpenter, 1982), dust sources treatment (Pedersen, 1998; Zhang et al., 1995) and ventilation (Bundy, 1991; Breum et al., 1990; Van't Klooster et al., 1993).

According to Wathes (1994), ventilation is in general still one of the most efficient methods for reducing inside air pollutants concentration, but its real influence on dust concentration has been recently more seriously investigated.

The research program of this work comprises the analysis of applying ventilation for dust concentration reduction and control in swine buildings air. This method is based on using the existing ventilation systems in stalls, and that is a very important advantage. Nevertheless, along with this advantage, many unsolved problems also appear, like working regime of ventilation system and choice of the proper type of system itself. The most important issues for particular cases in practice are: ventilation rate, inlet and outlet openings positioning and airflow directions through the building.

Materials and Methods

Fattening pigs house was separated in two lengthwise parts. One part was stocked with growing fattening pigs and the other one with finishers. Experimental room consisted of 18 boxes (2 x 9) (Fig. 1). Stock density was 10 finishers per box or 0.75 m^2/pig.

The room was ventilated by underpressure forced ventilation system. Inside air was extracted at the same time through the fans in the roof and under the slatted floor. Fresh air entered through windows.

Three axial ventilators (full capacity 4 m^3/s) in three vertical extracting canals (diameter 60 cm) were positioned in the roof.

Through the fully slatted floor, inside air was extracted by one axial fan (3.39 m^3/s), positioned in the outside vertical extracting canal (diameter 80 cm). That canal was connected to the horizontal longitudinal canal under the central feeding passage, which was also connected, along its walls, to a few openings, to the slurry canals and slatted floor of the boxes.

The whole facility was equipped with liquid manure cleaning system and the boxes floors were fully slated.

Fatteners were fed *ad libitum*, with the dry flour feed, from the self feeders mounted in side fences of the boxes, and watered from the nipple drinkers, mounted on the back wall of the box.

The other building (reproduction) was also lengthwise separated in the farrowing and weaned piglets rooms. Experimental room contained 36 wire boxes (2 x 18) (Fig. 2). Floors were made of fully perforated sheet iron, set at on 40 cm above the floor of central feeding passage. Stock density was 10 piglets per box, or 0.22 m^2/piglet.

Ventilation system was the same as in the previous case, as well as feeding, watering and manuring system. Full capacity of floor ventilation was 3.48 m^3/s, and the roof ventilation (four fans) 4 m^3/s.

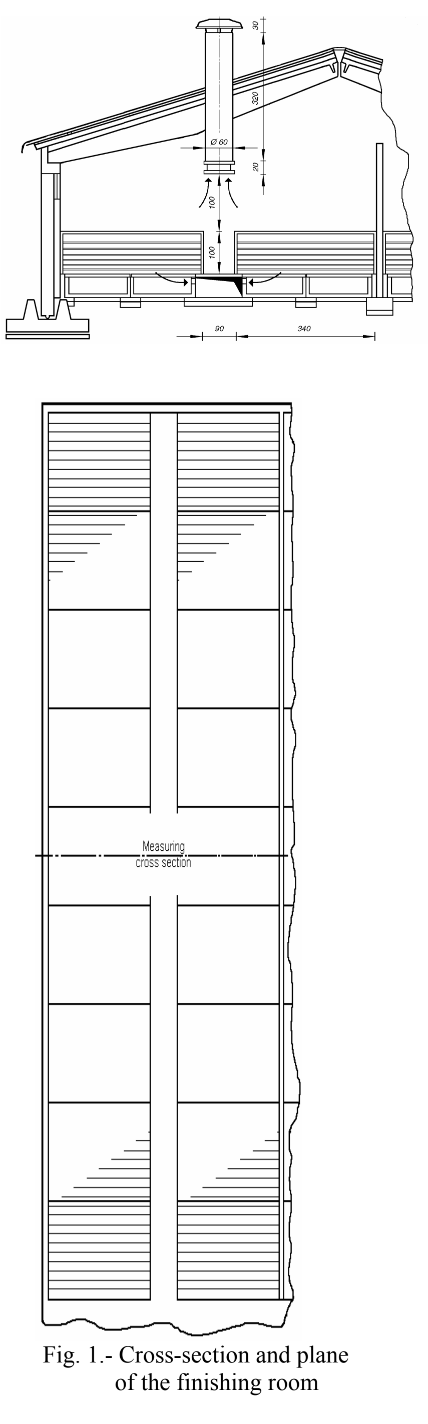


Fig. 1.- Cross-section and plane of the finishing room

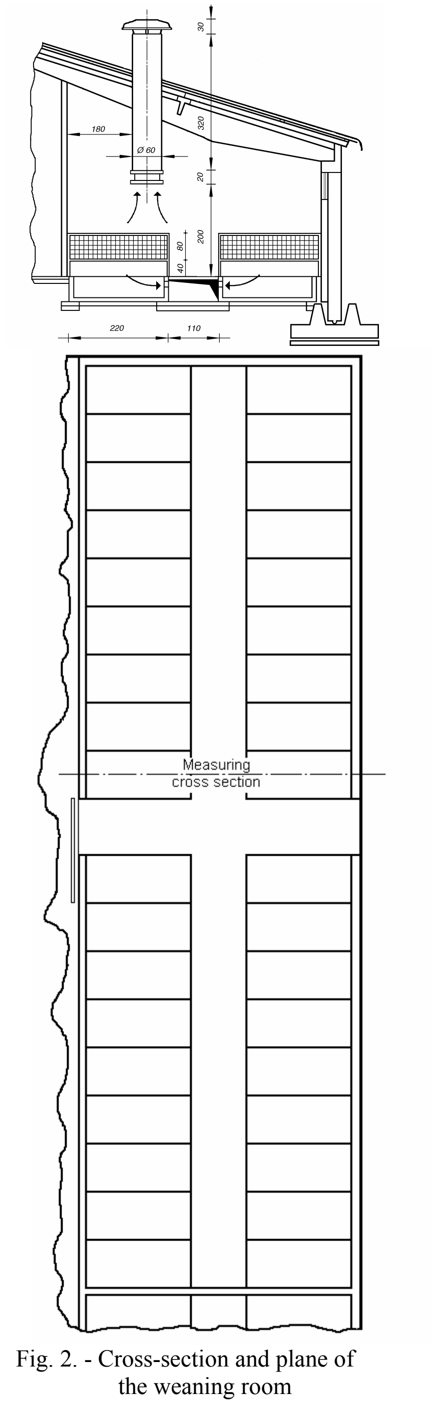


Fig. 2. - Cross-section and plane of the weaning room

During the *control treatment*, all the fans were switched off and all of the fresh air inlet openings were closed, so the fields of dust concentrations and airflow velocities over the measuring cross-section were almost stationary.

First experimental treatment was conducted during the operation of floor ventilation system in rooms.

Second experimental treatment was conducted during the operation of roof ventilation system in rooms.

Third experimental treatment was conducted during the operation of floor and roof ventilation system together ("both ventilations").

Inhalable (total) and respirable (< 5 μ) dust concentrations were measured.

Dust concentrations and airflow velocities were measured 30 minutes after establishing every experimental setup. It was supposed that 30 minutes period was enough for the measured values to change and reach stabile levels (Carpenter, 1987) as well as for pigs to reduce their activities after the change and to become peaceful again.

Every measurement was repeated three times, and later average values were processed from those three results.

Measurements were done continually through three weaning and finishing periods, during the season spring - summer - autumn 2000. During every period 8 measurements at equal 7-9 day intervals were managed. Values were not measured during and immediately after feed distribution in order to avoid increased dust concentrations from the feed and disturbed pigs.

Dust concentrations and airflow velocities were measured at 20 measuring points. The points were disposed over the central measuring cross-section, in five vertical and four horizontal rows (figures 3 and 4). Horizontal rows were distanced from each other at 40 cm, so the lowest row of 5 points was positioned in the pigs breathing zone (40 cm), and the highest in the workers breathing zone (160 cm).

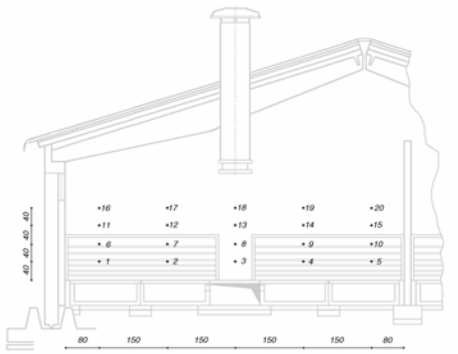


Fig. 3. - Measuring points disposal in the finishing room

Dust concentrations were measured by konimeter method, based on counting of dust particles in the air sample ("Konimeter 10", Karl Zeiss, Jena). Airflow velocities in ventilation canals were measured by turbine anemometer (measuring range 0 - 20 m/s, accuracy ± 0.1 m/s). Airflow velocities at measuring points inside the room were measured by hot wire anemometer (measuring range 0 - 2 m/s, accuracy ± 0.03 m/s). Air temperatures and humidity were measured by digital hygro-thermometer with NiCr - Ni thermo par.

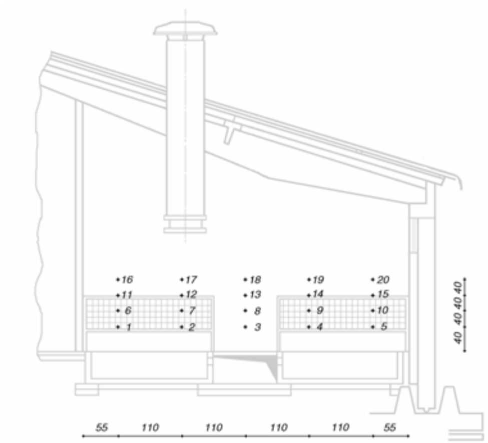
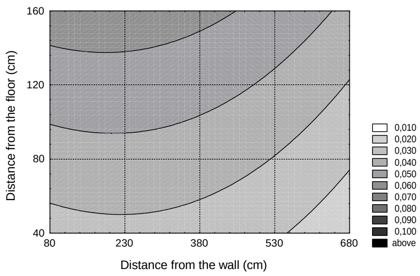


Fig. 4. - Measuring points disposal in the weaning room

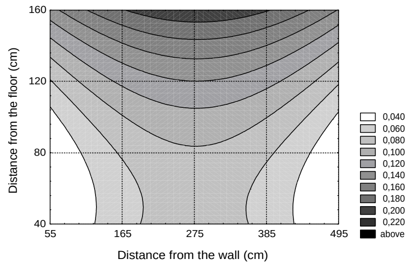
Results and Discussion

Airflow velocities in the finishing room, under floor ventilation ranged from 0.01 to 0.10 m/s (Graph. 1.). Increased values were noticed at higher measuring points of the third vertical row, as a result of the vertical ventilation canal influence. Similar effect was noticed at measuring points 6, 11 and 16, as a result of more intensive fresh airflow from the window. Minimal values (0.01 m/s) were measured at measuring points 5 and 10 where the so called "death zone" was clearly differentiated, which is an important disadvantage of this ventilation system.

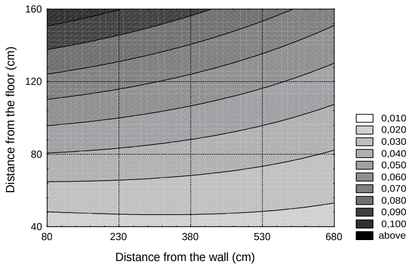
With the roof ventilation, airflow velocities ranged from 0.01 and 0.10 m/s as well (Graph. 2). Higher values (0.07 and 0.10 m/s) were again measured at higher points of the third vertical row, near the switched on fan. Velocity in lower layers of the room was 0.02 m/s, which was result of fresh incoming air direction to the higher parts of the room. The same tendency (0.01 - 0.03 m/s) was noticed at almost all measuring points at 40 and 80 cm above the floor, which is considered a serious disadvantage of this ventilation system because the whole animal breathing zone is not ventilated.



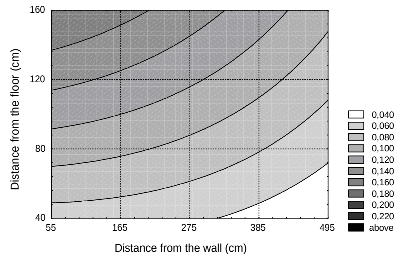
Graph. 1. – Airflow velocities in the fattening finishing room, floor ventilation system



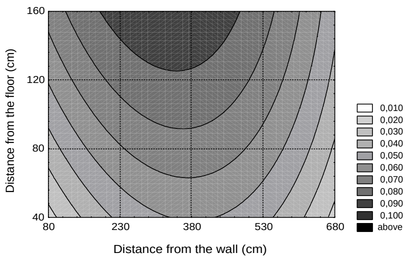
Graph. 4. – Airflow velocities in the weaned piglets room, floor ventilation system



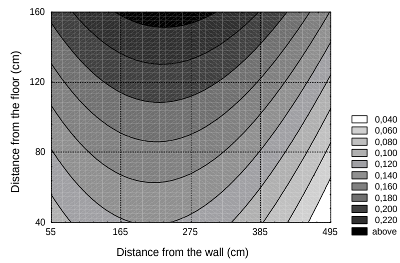
Graph. 2. – Airflow velocities in the fattening finishing room, roof ventilation system



Graph. 5. – Airflow velocities in the weaned piglets room, roof ventilation system



Graph. 3. – Airflow velocities in the fattening finishing room, both ventilation systems



Graph. 6. – Airflow velocities in the weaned piglets room, both ventilation systems

With both ventilations (Graph. 3), airflow velocities were between 0.02 and 0.10 m/s. Minimal value was measured at point 5, at 40 cm. The highest values were measured at points 12, 17 and 18, at 120 and 160 cm. From the aspect of airflow velocities distribution over the measuring cross-section, this ventilation system can be evaluated much better than the previous two. Animals breathing zone was better ventilated (0.02 - 0.05 m/s).

In the weaning room, with floor ventilation, airflow velocities (Graph. 4) ranged from 0.01 to 0.25 m/s. The lowest value was measured at point 1 at 40 cm, and the highest at point 18 at 160 cm. Higher values (0.12 - 0.25 m/s) were typical for all the points at 160 cm, because only these points were positioned above the box fences which were slowing down or even stopping the airflow. For the same reason at all the measuring points inside the boxes lower airflow velocities values were measured.

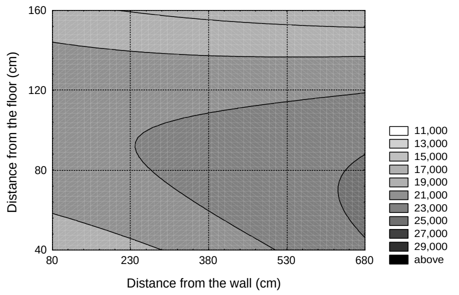
With the roof ventilation (Graph. 5) velocities were between 0.02 and 0.18 m/s. Minimal value was measured at point 5 at 40 cm and the highest at point 17. The influence of the roof ventilator was obvious here. Values in lower layers (40 and 80 cm) were very equable. In the fifth vertical row the grouping of values at two lower and two higher points was noticed. In higher ones values were a bit higher because of fresh airflow from the window, but the corner of the box near the outside wall was completely unventilated. Despite the mentioned disadvantage, in general, this ventilation system was better than the previous, and the whole piglets breathing zone was much better ventilated .

With both ventilations (Graph. 6) velocities were between 0.05 and 0.22 m/s. The lowest value was measured at point 5 at 40 cm, and the highest at point 12. Obviously, the velocities distribution was under dominant influence of the roof ventilators. Compared to roof ventilation, higher values were measured at all the points which was emphasized at points 2, 7, 14 and 19.

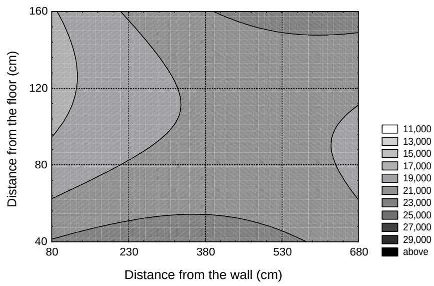
During the control treatment in the finishing room, the average inhalable dust concentration was 20 particles/cm^3 (Graph. 7). The highest value (26 particles/cm^3) was measured at point 15, and the lowest (14 particles/cm^3) at point 20. Average values at 40 and 160 cm above the floor were 21 and 16 particles/cm^3 respectively. This difference may be attributed to intensive dust sedimentation from higher layers in almost stationary conditions and absence of any ventilation.

In the first experimental treatment, the average inhalable dust concentration was 20 particles/cm^3 (Graph 8). The highest value (25 particles/cm^3) was noticed at points 18 and 19, and the lowest (13 particles/cm^3) at point 16. Average values at 40 and 160 cm were 21 particles/cm^3.

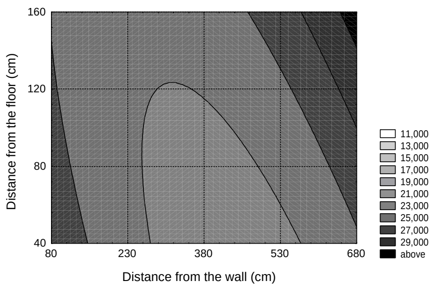
In the second experimental treatment, the average inhalable dust concentration was 25 particles/cm^3 (Graph. 9). The highest value (31 particles/cm^3) was measured at point 15, and the lowest (18 particles/cm^3) at point 8. Averages at 40 and 160 cm were 24 and 25 particles/cm^3. Average values are almost identical except in the second and third vertical rows where they slightly decreased because of air extraction through the outlet canal.



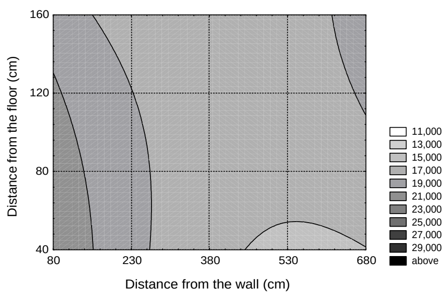
Graph. 7. – Inhalable dust concentrations in the fattening finishing room, no ventilation



Graph. 8. – Inhalable dust concentrations in the fattening finishing room, floor ventilation



Graph. 9. – Inhalable dust concentrations in the fattening finishing room, roof ventilation



Graph. 10. – Inhalable dust concentrations in the fattening finishing room, both ventilations

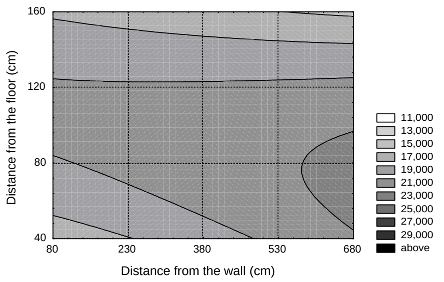
In the third experimental treatment, the average inhalable dust concentration was 17 particles/cm^3 (Graph. 10). The highest concentration (26 particles/cm^3) was measured at point 1, and the lowest (10 particles/cm^3) at point 4. Averages at 40 and 160 cm were 17 particles/cm^3. It is interesting to note that the average values in all horizontal rows were equal, which may be the result of equal airflow velocities distribution under this ventilation system.

During the control treatment in the finishing room, the average respirable dust concentration was 18 particles/cm^3 (Graph. 11). The highest value (24 particles/cm^3) was measured at point 15, and the lowest (13 particles/cm^3) at points 1 and 20. Average values at 40 and 160 cm above the floor were 19 and 15 particles/cm^3 respectively.

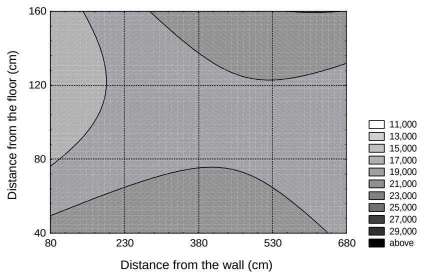
In the first experimental treatment, the average respirable dust concentration was 19 particles/cm^3 (Graph 12). The highest value (24 particles/cm^3) was noticed at points 18 and 19, and the lowest (13 particles/cm^3) at point 16. Average values at 40 and 160 cm were 19 and 20 particles/cm^3.

In the second experimental treatment, the average respirable dust concentration was 23 particles/cm^3 (Graph. 13). The highest value (29 particles/cm^3) was measured at point 15, and the lowest (17 particles/cm^3) at point 8. Averages at 40 i 160 cm were 23 and 24 particles/cm^3.

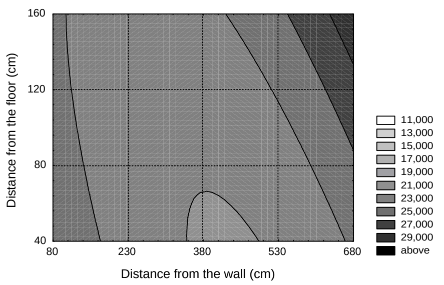
In the third experimental treatment, the average respirable dust concentration was 16 particles/cm^3 (Graph. 14). The highest concentration (22 particles/cm^3) was measured at point 1, and the lowest (10 particles/cm^3) at point 4. Averages at 40 and 160 cm were 15 and 16 particles/cm^3.



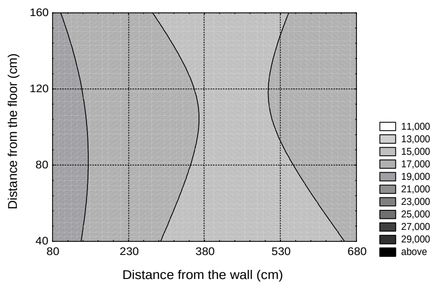
Graph. 11. – Respirable dust concentrations in the fattening finishing room, no ventilation



Graph. 12. – Respirable dust concentrations in fattening finishing room, floor ventilation



Graph. 13. – Respirable dust concentrations in the fattening finishing room, roof ventilation

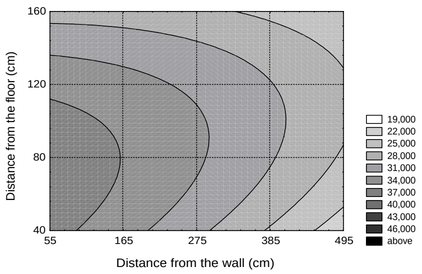


Graph. 14. – Respirable dust concentrations in the fattening finishing room, both ventilations

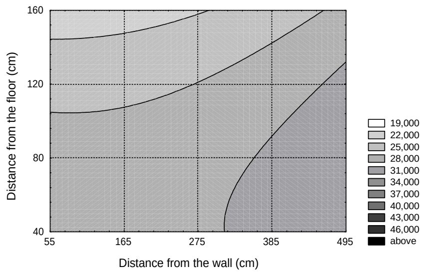
During the control treatment in the weaning room, the average inhalable dust concentration was 32 particles/cm^3 (Graph. 15). The highest value (39 particles/cm^3) was measured at point 4, and the lowest (21 particles/cm^3) at point 8. Average values at 40 and 160 cm above the floor were 33 and 28 particles/cm^3 respectively. Similar to the finishing room, under the same conditions, here the average value at 160 cm was lower than the others, also as a result of dust sedimentation. Here it was typical that the concentration in the middle of the feeding passage was also lower, which means that piglets themselves were an important source of dust production.

In the first experimental treatment, the average inhalable dust concentration was 26 particles/cm^3 (Graph 16). The highest value (38 particles/cm^3) was noticed at point 9, and the lowest (19 particles/cm^3) at point 13. Average values at 40 and 160 cm were 27 and 24 particles/cm^3. The highest values which were the same as in the control treatment were again measured close to the piglets bodies.

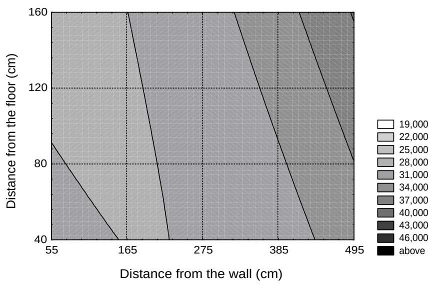
In the second experimental treatment, the average inhalable dust concentration was 30 particles/cm^3 (Graph. 17). The highest value (41 particles/cm^3) was measured at point 4, and the lowest (22 particles/cm^3) at point 7. Averages at 40 i 160 cm were 30 and 31 particles/cm^3. The average concentration from the points close to the window was higher (33 - 35 particles/cm^3), but the values in the passage and the inside box were lower (26 - 29 particles/cm^3), because of intensive extracting of polluted air through the outlet canal over the inside box.



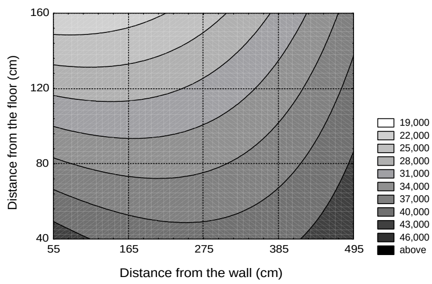
Graph. 15. – Inhalable dust concentrations in the weaned piglets room, no ventilation



Graph. 16. – Inhalable dust concentrations in the weaned piglets room, floor ventilation



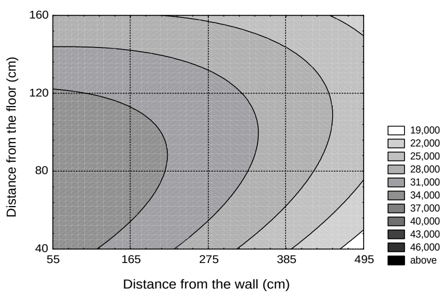
Graph. 17. – Inhalable dust concentrations in the weaned piglets room, roof ventilation



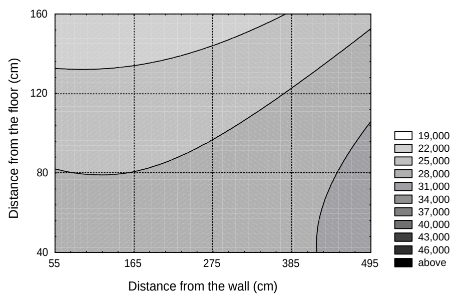
Graph. 18. – Inhalable dust concentrations in the weaned piglets room, both ventilations

In the third experimental treatment, the average inhalable dust concentration was 33 particles/cm^3 (Graph. 18). The highest concentration (49 particles/cm^3) was measured at point 4, and the lowest (18 particles/cm^3) at point 16. Averages at 40 and 160 cm were 40 and 25 particles/cm^3. Here was also noticed the difference between averages of vertical row near the window and the others inside the boxes and the passage. Concentrations in lower layers were also significantly higher. Besides the dust sedimentation, higher concentrations in lower parts were caused by piglets.

During the control treatment in the weaning room, the average respirable dust concentration was 30 particles/cm^3 (Graph. 19). The highest value (37 particles/cm^3) was measured at point 14, and the lowest (19 particles/cm^3) at point 8. Average values at 40 and 160 cm above the floor were 31 and 27 particles/cm^3 respectively.

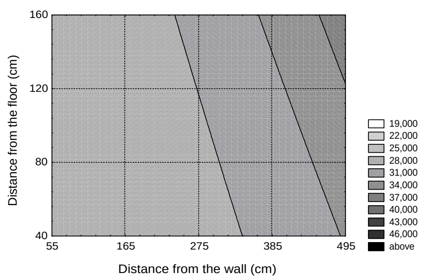


Graph. 19. – Respirable dust concentrations in the weaned piglets room, no ventilation

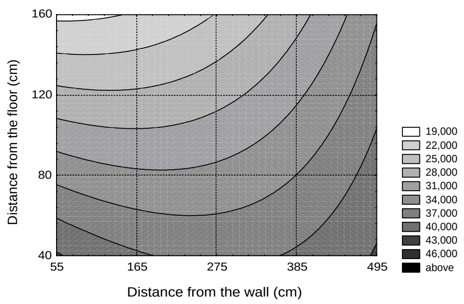


Graph. 20. – Respirable dust concentrations in the weaned piglets room, floor ventilation

In the first experimental treatment, the average respirable dust concentration was 25 particles/cm^3 (Graph. 20). The highest value (36 particles/cm^3) was noticed at point 9 and the lowest (18 particles/cm^3) at point 13. Average values at 40 and 160 cm were 26 and 22 particles/cm^3.



Graph. 21. – Respirable dust concentrations in the weaned piglets room, roof ventilation



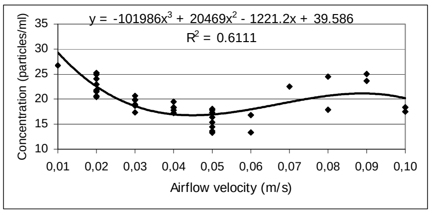
Graph. 22. – Respirable dust concentrations in the weaned piglets room, both ventilations

In the second experimental treatment, the average respirable dust concentration was 29 particles/cm^3 (Graph. 21). The highest value (40 particles/cm^3) was measured at point 4 and the lowest (21 particles/cm^3) at point 7. Averages at 40 and 160 cm were 29 particles/cm^3.

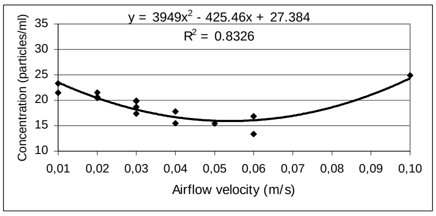
In the third experimental treatment, the average respirable dust concentration was 31 particles/cm^3 (Graph. 22). The highest concentration (46 particles/cm^3) was measured at point 4, and the lowest (16 particles/cm^3) at point 16. Averages at 40 and 160 cm were 39 and 24 particles/cm^3.

From the results of correlation and regression analysis of total data in the finishing room, a strong third-degree polynomial dependency of dust concentration distribution to airflow velocities was found (coefficient of determination R^2 = 0.6111). Velocities range from 0.02 - 0.08 m/s was emphasized as interval maintaining inhalable dust concentrations below 20 particles/cm^3 (Graph. 23).

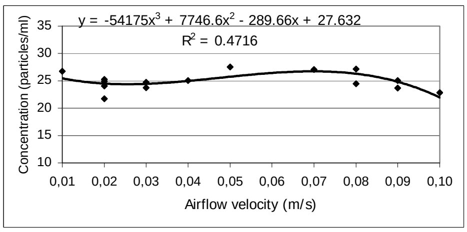
With the floor ventilation in the finishing room, a very strong second-degree polynomial dependency was calculated (R^2 = 0.8326). Air velocities range from 0.02 - 0.09 m/s was noticed again (Graph. 24).



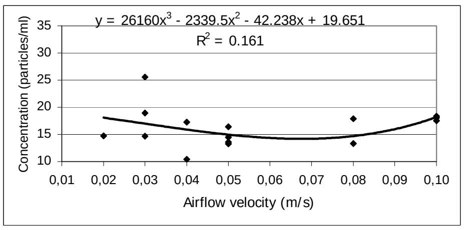
Graph. 23. - Dependence of dust concentration on airflow velocity in the finishing fattening house, all cases



Graph. 24. - Dependence of dust concentration on airflow velocity in the finishing fattening house, floor ventilation

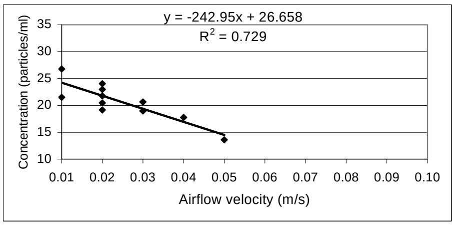


Graph. 25.- Dependence of dust concentration on airflow velocity in the finishing fattening house, roof ventilation

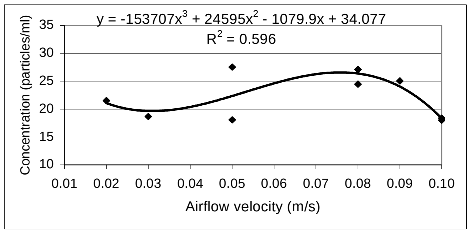


Graph. 26. - Dependence of dust concentration on airflow velocity in the finishing fattening house, both ventilations

In experimental treatments with roof and both ventilations medium and weak correlation was found, thus it can be concluded that dust concentration distribution in these cases was significantly influenced by some other factors which were not analyzed in this investigation. (Graphs 25 and 26).



Graph. 27. - Dependence of dust concentration on airflow velocity in the finishing fattening house, total, fatteners breathing zone

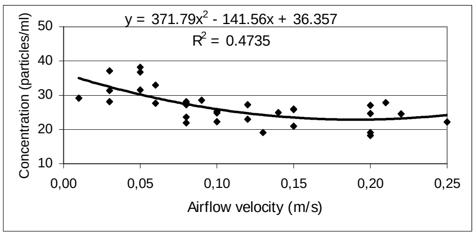


Graph. 28. - Dependence of dust concentration on airflow velocity in the finishing fattening house, total, humans breathing zone

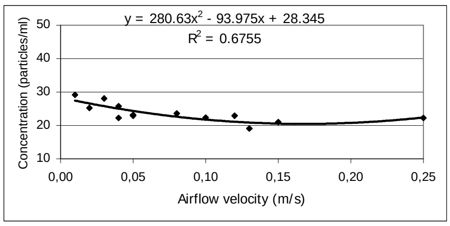
In both breathing zones (40 cm and 160 cm) strong correlations (linear - R^2 = 0.729 and third-degree polynomial - R^2 = 0.596, respectively) were found with optimal velocity range from 0.02 - 0.05 m/s. It was concluded that dust concentrations in breathing zones can be significantly controlled by proper airflow velocities (Graphs 27 and 28).

Airflow velocities out of the mentioned range, caused increasing dust concentrations.

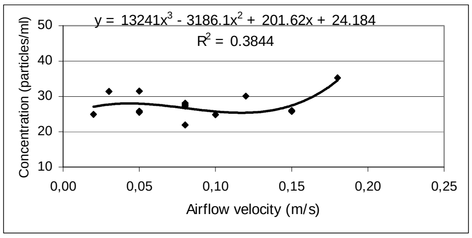
In the weaning house were mainly noticed medium strong dependences of dust concentrations distribution on airflow velocities, so it could be concluded that the influence of other factors on dust concentrations was more significant than the influence of air velocities. (Graphs 29 - 34).



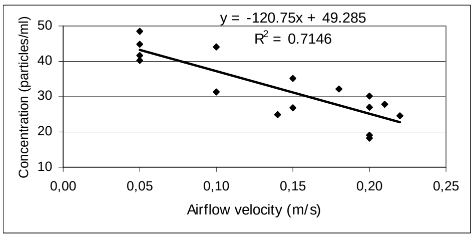
Graph. 29. - Dependence of dust concentration on airflow velocity in the weaned piglets house, all cases



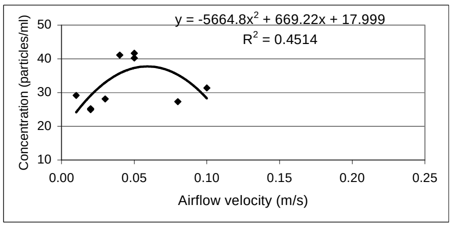
Graph. 30. - Dependence of dust concentration on airflow velocity in the weaned piglets house, floor ventilation



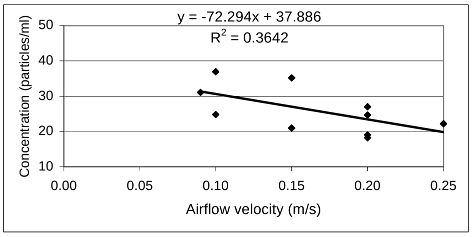
Graph. 31. - Dependence of dust concentration on airflow velocity in the weaned piglets house, roof ventilation



Graph. 32. - Dependence of dust concentration on airflow velocity in the weaned piglets house, both ventilations



Graph. 33. - Dependence of dust concentration on airflow velocity in the weaned piglets house, total, piglets breathing zone



Graph. 34. - Dependence of dust concentration on airflow velocity in the weaned piglets house, total, humans breathing zone

Nevertheless, strong correlations were found only in treatments with floor and both ventilations (second degree polynom - R^2 = 0.6755, linear function - R^2 = 0.7146, respectively). According to the results of these two experimental designs, it was concluded that increasing airflow velocities over 0.10 m/s, in the weaning room tend to decrease dust concentrations.

Conclusion

In the finishing room, under floor, roof and both ventilations, airflow velocities were: 0.01 - 0.10 m/s, 0.01 - 0.10 m/s and 0.02 - 0.10 m/s respectively.

In the weaning room, under floor, roof and both ventilations, airflow velocities were: 0.01 - 0.25 m/s, 0.02 - 0.18 m/s and 0.05 - 0.22 m/s respectively.

In the finishing room, under floor, roof and both ventilations, average inhalable dust concentrations were 20, 20, 25 and 17 particles/cm^3 respectively.

In the finishing room, under floor, roof and both ventilations, average respirable dust concentrations were 18, 19, 23 and 16 particles/cm^3 respectively.

In the weaning room, under floor, roof and both ventilations, average inhalable dust concentrations were 32, 26, 30 and 33 particles/cm^3 respectively.

In the weaning room, under floor, roof and both ventilations, average respirable dust concentrations were 30, 25, 29 and 31 particles/cm^3 respectively.

In the finishing room, roof ventilation caused very significant increment, and both ventilations caused very significant decrement of both dust fractions concentrations.

In the weaning room, floor ventilation caused very significant decrement of both dust fractions concentrations.

In the finishers breathing zone, by roof ventilation, very significant increment of both dust fractions concentrations was achieved, and with both ventilations system very significant decrement of dust concentrations was achieved.

In the piglets breathing zone, by floor ventilation, very significant decrement of dust concentrations was achieved, and by both ventilations very significant increment was achieved.

In the humans breathing zone, in the finishing room, by the roof, as well as both ventilations, very significant increment of dust concentrations was achieved.

In the same zone in the weaning room, by floor, as well as both ventilations, very significant decrement of dust concentrations was achieved.

According to all the mentioned criteria, the best results in the finishing room were achieved by both ventilation systems, and in the weaning room by floor ventilation system.

In the finishing room, with the floor ventilation, a very strong correlation between dust concentration and airflow velocity was found. During the other treatments medium and strong correlations were found. Regression functions were linear and second- or third-degree polynomes.

Air flow velocities below 0.02 and over 0.08 m/s caused increment of dust concentrations. Dust concentrations in both breathing zones can be significantly controlled and reduced by airflow velocities ranging from 0.02 - 0.05 m/s.

In the weaning room, during all treatments, mainly medium correlations were calculated with the exception of floor and both ventilations where the correlations were strong. Regression functions were linear and second- or third-degree polynomes.

Increment of airflow velocity, especially over 0.10 m/s, resulted in dust concentration reduction in the weaning room.

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PROUČAVANJE UTICAJA RAZLIČITIH VENTILACIONIH SISTEMA NA RASPODELU KONCENTRACIJA ČESTICA INHALABILNE I RESPIRABILNE PRAŠINE U OBJEKTIMA ZA ODGOJ I ZAVRŠNI TOV SVINJA

G. Topisirovic[1]

R e z i m e

U radu su analizirane primene ventilacije u smanjenju i kontroli sadržaja prašine u stajskom vazduhu objekata za odgoj i završni tov svinja.

Koncentracije prašine i brzine strujanja vazduha su merene u po 20 mernih tačaka, ravnomerno raspoređenih po mernom preseku, u 4 horizontalna i 5 vertikalnih nizova. Donji niz tačaka je bio u zoni disanja tovljenika i prasadi (40 cm), a četvrti gornji u zoni disanja zaposlenih (160 cm). Kontrolne vrednosti su merene u objektu sa isključenim ventilatorima i zatvorenim prozorima, a tri ogledne varijante obuhvataju: podni, krovni i oba ventilaciona sistema.

Koncentracija prašine je merena konimetarskom metodom (Konimetar 10, Karl Zeiss, Jena), brzina strujanja vazduha u ventilacionim kanalima turbinskim anemometrom, a u objektu anemometrom sa toplom žicom.

U objektu za završni tov, sa obe ventilacije je postignuto statistički značajno smanjenje koncentracije inhalabilne ($F = 44.35$, $P << 0.01$) i respirabilne prašine ($F = 43.82$, $P << 0.01$). U objektu za odgoj prasadi, podnom ventilacijom je postignuto statistički značajno smanjenje koncentracije inhalabilne ($F = 49.43$, $P << 0.01$) i respirabilne prašine ($F = 42.69$, $P << 0.01$).

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