DESIGN OF SIEVE-ROLL COMBINED PEANUT PODS CLEANING DEVICE
/
筛-辊组合式花生荚果清选装置设计

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ABSTRACT

In order to meet the requirements of peanut pods cleaning by the pick-up peanut combine harvester, and enhance the processing ability of branches, leaves, broken stalks and hard fruit stalks of the cleaning system, a kind of sieve-roll combined peanut pods cleaning device was designed based on the analysis of material cleaning characteristics. It mainly includes key components, such as cross flow fan, vibrating screen and separation roller. The force and movement state of the picking peanut extraction on the sieve surface and the separation roller were analysed. Through field loading test and verification, when the vibration screen width is 1200 mm, the crank speed is 650 rpm, the cross flow fan speed is 920 rpm, the separation roll speed is 410 rpm, the separation roll gap is 3 mm, then the peanut pod containing impurities rate is 1.52% and the loss rate is 0.64%, which meets the national industry standards.

摘要

为了满足捡拾式花生联合收获机对花生荚果的清选要求，增强清选系统对枝叶、断杆和硬果梗的处理能力，在物料清选特性分析的基础上，设计了一种筛-辊组合式花生荚果清选装置，主要包括横流风机、振动筛、分离辊等关键部件。对花生摘果脱出物在筛面和分离辊上的受力及运动状态进行了分析．通过田间装机试验验证，当振动筛宽度为 1200mm，曲柄转速为 650r/min、横流风机转速为 920r/min、分离辊转速为 410r/min、分离辊间隙为 3mm 时，花生荚果的含杂率为 1.52%，损失率为 0.64%，满足国家行业标准要求。

INTRODUCTION

Peanut is an important oil crop in China, with a total output of 17 million tons, which is accounting for about 40% of the global total output, ranking first in the world *(Liao, 2003; Liu, 2011)*. According to the statistics of mechanization department of agriculture ministry, the mechanization rate of peanut harvest in China is about 33%, which has become the main bottleneck restricting the development and benefit growth of peanut industry in China *(Zheng and Li, 2005)*. The pick-up peanut combine harvester is an important model in the two-stage harvesting of domestic peanuts due to its large feeding capacity and high harvesting efficiency *(Lv Xiaolian et al., 2012)*.

As an important part of the peanut harvester, the operating performance of the cleaning device directly affects the operating quality and production efficiency of the whole machine *(Tang et al., 2016; Mekonnen Gebreslasie Gebrehiwot et al., 2010; K. Maertens et al., 2000)*. During the operation of the harvester, the excavated peanut plants are sent into the picking mechanism by the harvester, and the peanut vine is discharged from the grass outlet of the picking mechanism. The peanut pods, stems, light sundries, hard fruit stalks and lumps fall into the cleaning device through the separation concave plate of the picking mechanism.

At present, the foreign peanut combine harvester has structural innovations in the cleaning system, for example, a gas stream that can be adjusted at any time is attached to the cleaning sieve; using a higher volume vacuum fan, the debris is gradually raised as the peanuts fall to the back of the shaker plate. The existing fan-vibrating screen cleaning system is widely used in the existing peanut harvesting machines in China (*Liu, 2018*).

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Because the basic physical parameters such as the shape, size and density of the peanut pod extract are different *(Chakraborty et al., 2018; Zdzisław Kaliniewicz, Zbigniew Żuk, 2018)*, this sorting system cannot effectively remove the broken stem and hard fruit stem in the material.

Due to the differences in the shape, size, density and other basic physical parameters of the components of peanut extraction *(Chakraborty et al., 2018; Zdzisław Kaliniewicz, Zbigniew Żuk, 2018)*, the existing peanut harvesters generally use the traditional fan-vibrating screen cleaning system, which cannot effectively remove the broken stalks and hard stalks in the material, meanwhile there are some problems, such as high content of stem breakage, large loss of pod and poor adaptability (*Liu, 2018*). Therefore, it is of great theoretical significance and practical value to develop a new type of cleaning and removing system suitable for the pick-up peanut combine harvester.

In order to effectively solve the problem of cleaning and removing impurities in the pick-up peanut combine harvester, this paper designs a kind of sieve-roller combined peanut pod cleaning device, which is able to reduce the overall size and increase the adaptability of peanut harvester on the premise of ensuring the cleaning and sorting performance. On the basis of theoretical calculation, from the kinematics point of view, the force and motion state of the picking peanut extraction on the sieve surface and the separation roller are analyzed; the conditions for the normal work of the separation roller are given; and the velocity formula of the exudates in the cleaning device is deduced. Moreover, through the field verification test, impurity content and the loss rate of the cleaning device during operation are obtained.

MATERIALS AND METHODS

Study on the cleaning characteristics of picking peanut extraction

Proportion of extraction

Picking peanut extraction refers to all the materials separated by the concave plate after the picking roller picks the fruits, mainly including peanut pods, broken culms, roots, light sundries, soil, etc. and all components are mixed in a certain proportion. The peanut used in this experiment is Yuhua No.15, and the picking mechanism adopts the full-feed picking roller. The moisture content of peanut pod and stem measured at the time of fruit picking was 18% and 15% respectively. The picking peanut extraction was classified, weighed as well as calculated, and the results were as shown in Tab.1.

Table 1

Components and proportion of the picking peanut extraction

Components	Peanut pods	Break culms and stalks	Impurities	The soil
The proportion [%]	65.82	13.52	11.01	9.65

Measurement and statistical analysis of the shape and size of peanut pods

At harvest time, each peanut plant will have about 15 to 40 pods, most of which are mature and full, but there are also a few immature pods. Each pod usually contains one or two peanuts, and the morphology of these pods varies greatly. Due to the irregular appearance of peanut pod, the pod was approximately regarded as a cuboid for easy measurement, and its shape characteristics were described by measuring its length, width and thickness. 100 samples were randomly selected from peanut pods used in the experiment; the length, width and thickness of each sample were measured by digital vernier caliper; and the measurement results were recorded. Statistical analyses were carried out on the measurement results, which were as shown in Tab. 2.

Table 2

Statistical analysis of peanut pods physical dimension

Statistical parameter	Pod length [mm]	Pod width [mm]	Pod thickness [mm]
The minimum	17.09	11.66	8.7
The maximum	42.22	19.12	16.88
The average	31.678	15.304	13.998
The standard deviation	7.217	2.248	2.280
Coefficient of variation [%]	22.8	14.7	16.2

Determination of length and diameter of broken stalks

Broken stalks are the impurities with the largest proportion in the picking peanut extraction. When peanuts are fully fed and picked, a large number of broken stalks will be produced in the extraction components, especially when the moisture content of peanut plant is low. In order to remove the broken stalks in the extraction better, the broken stalks should be graded according to different lengths. In this paper, the broken stalks were divided into three grades according to the length less than 50 mm, between 50 and 130 mm and greater than 130 mm, and their proportions were counted. The statistical results show that the stalk with the length between 50 and 130 mm takes the largest proportion, accounting for 56%, followed by the stalk with the length greater than 130 mm, accounting for 34%, and the short stalk with the length less than 50 mm takes the smaller proportion, accounting for 10%. A large number of broken culms were randomly selected as samples from the picking peanut extraction. Through measurement and statistical analysis, it was found that the diameter of the broken culms was 1.3-5.2 mm.

Suspension velocity of picking peanuts extraction

Suspension speed refers to the velocity of the airflow when the material acts under the vertical airflow, and the force of the airflow on the object is equal to the weight of the object itself to keep the object in suspension *(Ghafori and Ebrahimi, 2018)*. It is one of the important factors affecting the movement of materials in the airflow field *(Ma Zheng et al., 2011)*. In this paper, DFPF-25 suspension velocity test device was selected to measure the suspension velocity of each component of the extraction. Its structure is as shown in Fig.1. The small end diameter of the conical tube is 81mm and the angle of the conical top is 5.5°. The device adopts a variable speed motor as the supporting power. The power of the motor is 5.5 kW, the speed adjustment range is 300~1000 rpm, and the maximum suspension speed can be measured to be 25 m/s. The measurement results are as shown in Table 3.

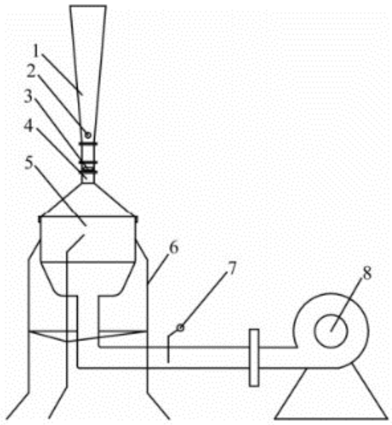

Fig. 1 - Schematic diagram of floating velocity instrument for peanut mixture
1-Tapered tube; 2-Pitot tube speed gauge; 3-Material release port; 4-Convergence tube; 5-Voltage regulator tube; 6- Stents; 7-Damper; 8-Fan

Table 3

Floating velocity of peanut mixture

Determined material	Minimum suspension Velocity [m/s]	Maximum suspension Velocity [m/s]
Plump pod	7.5	9.7
Incomplete pod	4.5	6.3
Long stem	4.2	5.9
Short stalk	3.6	4.0
Impurities	2.1	3.2

It can be found from the results in Table 3 that the suspension speed of full peanut pod is the highest, followed by that of incomplete peanut pod and long stalk, and that of light sundries is the lowest. Among them, the suspension speed of peanut pod is much higher than that of light sundries and short stalk, while the range of suspension speed of long and short stalks overlaps to some extent.

The whole design and working principle of cleaning mechanism

According to the research on the cleaning characteristics of picking peanut extraction components, it can be known that it is necessary to use the air-and-screen cleaning mechanism to clean peanut pods. Therefore, a kind of sieve-roll combined peanut pods cleaning device is designed in this paper. Its structure is as shown in Fig.2. During work, the picking peanut mixture is discharged onto the vibrating screen of the cleaning device through the separating concave plate of the picking mechanism, and moves toward the tail of the vibrating screen. Under the stratification of the vibrating screen, the clods with small volume and large weight in the materials are located at the bottom layer of the material and then fall below the screen surface through the sieve hole of the vibrating screen. The light sundries with large volume and light weight and the short stalk are located on the top layer of the material. When moving to the tail of the vibrating screen, it is sucked away by the cross-flow fan and discharged from the air outlet. The remaining material is peanut pods and some large stalks as well as rhizomes with large volume and large mass. When they fall onto the stalk removal device and move along the axial direction of the separation roller, several pairs of oppositely rotating separation rollers will pick up the long stalks and rhizomes of smaller diameter, which will be sent to the lower side of the separation roller. Until only the clean peanut pods remain on the stalk removal device and then fall through the fruit outlet into the fruiting device, the peanuts are cleaned and sorted.

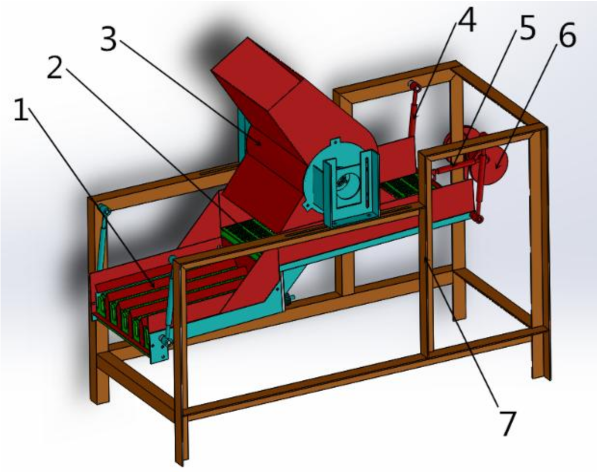

Fig. 2 - Structural schematic diagram of screen-roller combined peanut pod cleaning device

1-Separation roller; 2-Vibrating screen; 3-Cross flow fan; 4-Derrick; 5-Connecting rod;6-The crank; 7-Stents

Design of key component

Cross flow fan

The cross-flow fan designed in this paper is as shown in Fig.3, which is mainly composed of impeller and fan casing. The impeller is multi-bladed and mainly composed of forward-curved blades, flanges, blade-wheel axles, bearings, and belt wheels, etc. The fan casing is mainly composed of a side plate sealed on both sides, a volute and a volute tongue, which is welded by a steel plate with a thickness of 1.5 mm. Volute inner wall profile is an Archimedes spiral.

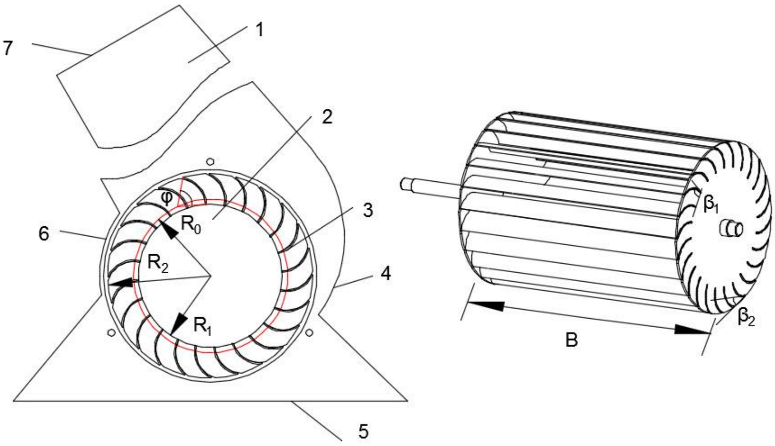

Fig. 3 - Structure diagram of cross-flow fan

1-Shell; 2-The impeller; 3-Leaf blade; 4-Pan; 5-Air inlet; 6- Tongue; 7-The outlet;

Where R_1 is inner radius of impeller, R_1 =91mm; R_2 is outer radius of impeller, R_2 =91mm; Z is the number of blade, Z=24; β_1 is the blade inlet mounting angle, β_1=90°; β_2 is the blade outlet mounting angle, β_2=25°; B is the impeller width, B=580 mm.

The calculation formula of the radius of curvature R of the blade, the positioning radius R_0 of the centre of the blade and the central angle φ corresponding to the arc length of the blade is:

$$R=\frac{R_2^2-R_1^2}{2(R_2\cos\beta_2-R_1\cos\beta_1)} \tag{1}$$

$$R_0=2R_2\sqrt{\frac{R}{2R_2}(\frac{R}{2R_2}-\cos\beta_2+0.25)} \tag{2}$$

$$\varphi_1=\cos^{-1}\frac{R^2+R_0^2-R_1^2}{2RR_0} \tag{3}$$

$$\varphi_2=\cos^{-1}\frac{R^2+R_0^2-R_2^2}{2RR_0} \tag{4}$$

$$\varphi=\varphi_2-\varphi_1 \tag{5}$$

R, R_0 and φ are calculated by substituting the above parameters data into the formula (1) to (5). The calculated radius of blade curvature R is 36.58 mm, the positioning radius of the blade centre R_0= 98.07 mm and the central angle corresponding to the blade arc length φ = 77.83 °.

Vibrating screen and Separation rollers

Vibrating screen is generally composed of vibrator, screen surface, supporting or suspension device, transmission device and other parts *(Li, 2003)*. The screen surface of the vibrating screen designed in this paper is as shown in Fig.4. The screen hole is a strip hole. According to the design principle, the narrow side width of the strip hole $a=(0.7\sim0.8)d_{max}$, and the long side width $b=(1.1\sim1.15)d_{max}$. In order to ensure that dirt and other debris pass through the sieve hole, while the peanut pod does not pass through the sieve hole, d_{max} is taken as the average value of the thickness of the peanut pod, which is 13.998 mm; and both a and b take the minimum value; the narrow width of the sieve hole is 9.8 mm and the long side width is 15.4 mm.

As shown in Fig.5, the action of the separating roller is to grab the long stalk and root in the extraction components. The separating roller is made of nylon rod. The two ends are inlaid with steel shaft head, which is installed on the special bearing support by bearing. External mesh gears are used to transfer power between the separation rollers, besides that the modulus and number of teeth of the adopted gears are the same. The rotation speed of each two adjacent spur gears is the same and the direction is opposite. The active roller is connected with the speed regulating motor through the V-belt, and controlling the digital frequency converter can achieve the purpose of adjusting the speed of the separation roller.

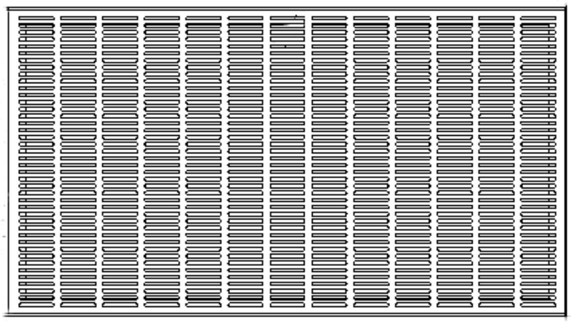

Fig. 4 - Vibrating screen surface

Fig. 5 - Physical drawing of separating rollers

RESULTS

Force and motion analysis of extraction

Force and motion analysis of the extraction on the screen surface

When the extraction slides down the vibrating screen, it will be affected by the three forces of its own gravity G, the supporting force F_N of the screen facing the material and the frictional force F_f of the screen facing the material, as shown in Fig.6.

However, when the material slides down to the inlet of the cross-flow fan, under the action of the high-speed airflow, the light debris and short stalks with smaller suspension speed will leave the screen surface and move upwards obliquely with the airflow. At this point, they are only affected by two forces, namely their own gravity G and the airflow force F_p.

The direction of the force F_P of the air flow on the material is opposite to the direction of the relative velocity *v* of the material on the air flow.

Since each component moves independently of each other in the form of a single individual after the extraction enters the airflow field, and in order to facilitate analysis and calculation, each component of the picking peanut extraction is regarded as a spherical particle with mass *m*.

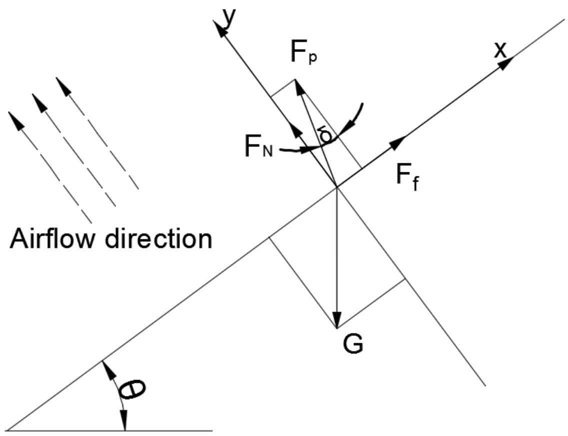

Fig. 6 - Force Analysis Diagram of Material on Screen Surface

According to Newton's formula, force F_P of airflow on material can be expressed by equation (6):

$$F_P = mK_P v^2 = m\frac{g}{v_P^2}v^2 \tag{6}$$

Where F_P is airflow force, [N]; K_P is floating coefficient; *m* is mass of material [kg]; v_P is floating speed [m/s]; *v* is relative velocity of material to airflow [m/s].

For the peanut pods and long stalks in the extraction, due to their large suspension speed, they will not leave the screen surface after being subjected to the airflow force, but will continue to slide along the screen surface. At this time, in addition to being subjected to the airflow force F_p, they are also subjected to the self-gravity G, the supporting force F_s of the screen facing the material, and the frictional force F_f of the screen facing the material. Since the material continues to slide down the screen surface, it can be seen that the direction in which the material is subjected to the resultant force is in the negative direction along the X-axis.

The resultant force is obtained by decomposing and synthesizing the above four forces:

$$F_x = G\sin\theta - F_f - F_P\sin\delta \tag{7}$$

Also, because the resultant force of the material on the y-axis is 0, so:

$$F_p\cos\delta + N - G\cos\theta = 0$$
$$N = G\cos\theta - F_P\cos\delta \tag{8}$$

Because of $F_t = \mu N$, if we substitute in the above equation, we can simplify it:

$$F_x = mg[(\sin\theta - \mu\cos\theta) - \frac{v^2}{v_P^2}(\sin\delta - \mu\cos\delta)] \tag{9}$$

Therefore, it can be calculated that the material sliding acceleration a is:

$$a = \frac{F_x}{m} = g[(\sin\theta - \mu\cos\theta) - \frac{v^2}{v_P^2}(\sin\delta - \mu\cos\delta)] \tag{10}$$

Where δ is the angle between the direction of the relative velocity of material to the flow *v* and the direction of the flow velocity, [°]; $\varnothing$ is angle of slide, [°].

Analysis of force and motion of the extraction on the separating roller

After being cleaned and sorted by air, the main materials that fall from the vibrating screen surface to the separation roller are peanut pods and long stalks. Under the action of their own gravity *G*, they will slide axially along the inclined separation roller, and at the same time, they will be guided by the guide plate into the material channel composed of the separation roller, meanwhile the long stem among them will be separated by a number of separation rollers rotating in opposite directions, as shown in Fig.7.

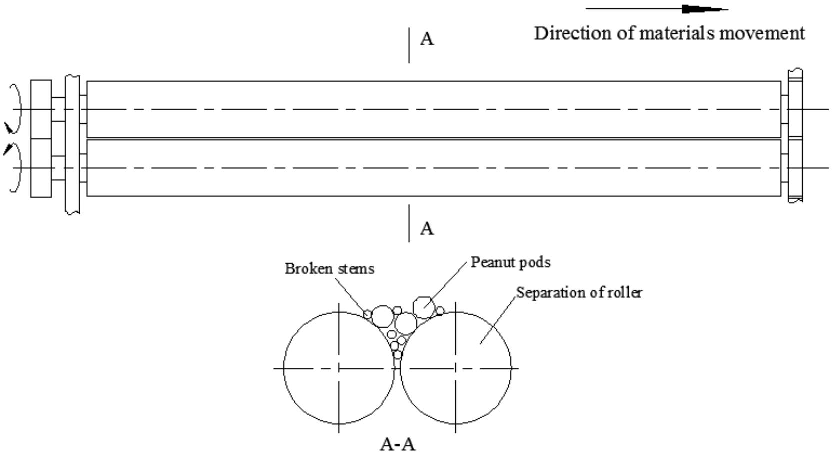

Fig. 7 - Position diagram of double separation rollers in relationship to each other

Analysis of force of extraction on separating roller

A properly functioning separation roll should be able to grab the long stem without damaging the peanut pod. In order to facilitate analysis, it is assumed that both the broken stem and peanut pod are regular cylindrical. When the long stem and peanut pod are grabbed by the separation roller, they are respectively subjected to the reaction forces *N*, N_g and the gripping forces *T* as well as T_g of the separating roller acting on the gripping portion, and the force analysis is as shown in Fig.8.

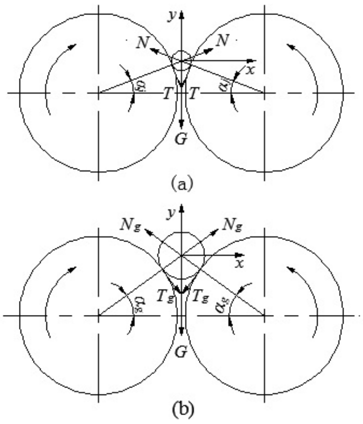

Fig. 8 - Diagram of force analysis
(a) Stress analysis diagram of broken stem (b) Stress analysis diagram of pod

For the separation roller to be able to grab the long stem without the influence of gravity, the resultant force on the *Y* axis of the long stem should be in the negative direction, it needs to be satisfied:

$$N\sin\alpha_{\mathrm{j}} - T\cos\alpha_{\mathrm{j}} < 0 \tag{11}$$

$$T = N\mu_{\mathrm{j}}$$

$$\tan\alpha_{\mathrm{j}} < \mu_{\mathrm{j}} \tag{12}$$

Where, μ_j is the friction coefficient between the separating roller and the long stalk; α_j is initial grasping angle of separating roller on long stem, [°].

When the separation roller grabs the long stem, in order to prevent the peanut pod from being squeezed and broken by the separation roller, the following conditions must be satisfied:

$$N_{\mathrm{g}}\sin\alpha_{\mathrm{g}} - T_{\mathrm{g}}\cos\alpha_{\mathrm{g}} > 0 \tag{13}$$

$$\tan\alpha_{\mathrm{g}} > \mu_{\mathrm{g}} \tag{14}$$

Where, μ_g is friction coefficient between separating roller and peanut pod; α_g is initial grab angle of separating roller to peanut pod, [°].

Set the friction angle between the separation roller and the long stem and peanut pod as $\varnothing_j$, $\varnothing_g$ respectively, then:

$$\mu_j = \tan\phi_j\,,\quad \mu_g = \tan\phi_g$$

The normal working conditions of the separation roller are: $\alpha_j < \varnothing_j$, and $\alpha_g < \varnothing_g$.

In conclusion, in order to work properly, the separation roller must satisfy the following conditions: the initial grasping angle α_j of the separation roller on the broken stem should be smaller than the friction angle $\varnothing_j$ between the separation roller and the broken stem, meanwhile the initial grasping angle α_g of the separation roller on the peanut pod should be larger than the friction angle $\varnothing_g$ between the separation roller and the peanut pod.

Motion analysis of the extraction on the separating roller

When the separation roller works normally, the material will slide down uniformly and accelerate in the direction parallel to the axis line of the separation roller, besides that the broken culms will be constantly grabbed and separated by the separation roller until only clean peanut pods are left. According to observation of experimental phenomena, peanut pod will rotate around its own axis while sliding down uniformly and accelerating on the separation roller. Its motion rule is analyzed by setting three-dimensional coordinate system, as shown in Fig.9.

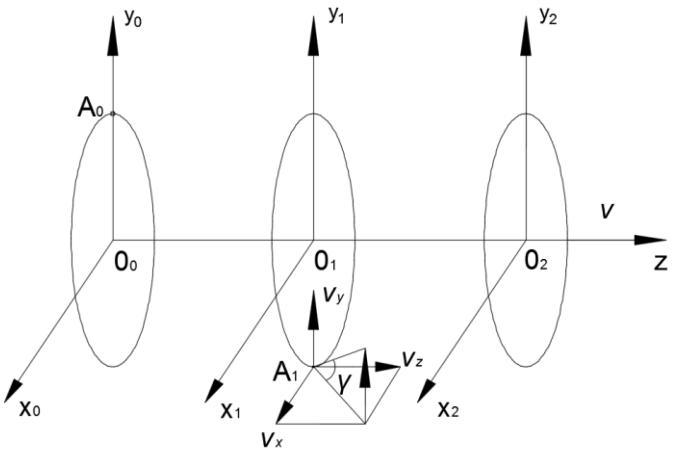

Fig. 9 - Kinematic analysis diagram of peanut pods

In this coordinate system, the origin point is the rotation centre of peanut pod; the z-axis coincides with the axis of pod centre; and the direction is the same as the axial movement direction of peanut pod. A_0 is the initial point of motion on the peanut pod; the $x_0O_0y_0$ plane, $x_1O_1y_1$ plane and $x_2O_2y_2$ plane are perpendicular to the z-axis, respectively; the $x_0O_0y_0$ plane is the plane; the pod motion initial point A_0 is located and the $x_1O_1y_1$ plane is the plane after the A_0 moves t seconds.

The coordinates of position A_1 after the initial point A_0 moves t seconds are:

$$\begin{cases} x = r\sin\omega t \\ y = r\cos\omega t \\ z = v_0 t + \frac{1}{2}at^2 \end{cases} \tag{15}$$

Where, r is the turning radius of peanut pod (mm); w is peanut pod rotation [rad/s]; v_0 is initial axial velocity of peanut pod movement [m/s]; a is acceleration of peanut pod axial movement [m/s^2]; $a=g(\sin\beta-\mu_g\cos\beta)$; β is the included angle between separating roller axis and horizontal plane.

By differentiating equation (15), the velocity v_1 and the speed direction angle at point A_1, can be obtained:

$$\begin{cases} v_x = \dfrac{dx}{dt} = r\omega\cos\omega t \\ v_y = \dfrac{dy}{dt} = r\omega\sin\omega t \\ v_z = \dfrac{dz}{dt} = v_0 + at \end{cases} \tag{16}$$

$$\left|\overrightarrow{v_1}\right| = \sqrt{v_x^2 + v_y^2 + v_z^2} = \sqrt{r^2\omega^2 + (v_0 + at)^2} \tag{17}$$

$$\gamma = \arctan\frac{v_y}{\sqrt{v_x^2 + v_z^2}} = \arctan\frac{r\omega\sin\omega t}{\sqrt{r^2\omega^2\cos^2\omega t + (v_0 + at)^2}} \tag{18}$$

The second differential of equation (16) is used to calculate the acceleration of point A_1 and the direction angle of acceleration φ is:

$$\begin{cases} a_x = \dfrac{dv_x}{dt} = -r\omega^2\cos\omega t \\ a_y = \dfrac{dv_y}{dt} = r\omega^2\sin\omega t \\ a_z = \dfrac{dv_z}{dt} = a \end{cases} \tag{19}$$

$$\left|\vec{a}\right| = \sqrt{a_x^2 + a_y^2 + a_z^2} = \sqrt{r^2\omega^4 + a^2} \tag{20}$$

$$\varphi = \arctan\frac{a_y}{\sqrt{a_x^2 + a_z^2}} = \arctan\frac{r\omega^2\sin\omega t}{\sqrt{r^2\omega^4\cos^2\omega t + a^2}} \tag{21}$$

Performance test

To test the cleaning effect of the screen-roller combined peanut pods cleaning device, the cleaning device was placed on the pick-up peanut combine harvester designed and produced by Henan Ruifeng Machinery Co., Ltd. In the late September of 2018, a field trial was conducted in a peanut test field on the outskirts of Jiaxian County in Xinxiang City, Henan Province. Peanut plants are first excavated from the soil by peanut excavators and laid into ridges. After drying for 3 to 5 days, they are picked up by the pick-up peanut combine harvester. The field harvesting test process is as shown in Fig. 10 (left). The quality of peanut pod harvesting and cleaning is as shown in Fig.10 (right).

According to field test, when the vibrating screen width is 1200 mm, the crank speed is 650 rpm, the cross-flow fan speed is 920 rpm, the separation roller speed is 410 rpm and the separation roller gap is 3 mm, the peanut pod has an impurity ratio of 1.52 %, the loss rate is 0.64%, the peanut pod cleaning device is applied to the pick-up peanut combine harvester with good effect. And it is found that the impurity content ≤2.0% and the cleaning loss rate ≤1.5%, which are meeting expected design requirements and satisfying the national industry standard requirements of NY/ T502-2016 "Peanut Harvester Operation Quality".

Fig. 10 - Field test process and cleaning effect of combine harvester for peanut picking-up

CONCLUSIONS

The theoretical basis for the design of the cleaning and separation devices is provided by studying the composition ratio of peanut extraction, 100-grain weight of pod, the size and difference of pod and broken straw, the friction coefficient of each component and the floating speed, etc.

The sieve-roll combined peanut pod cleaning and sorting device designed consists of cross-flow fan, vibrating screen, separation roller etc.

The vibrating screen sorts the clods with small volume and large mass; the cross-flow fan sucks away the light debris; the separation roller grabs and separates the long stems; and the trinity completes the clearing of the picking peanut extraction.

By analyzing the force and motion of the extraction components on the screen, the force of air flow on the material and the horizontal acceleration of material slide are obtained. By analyzing the force and motion of the extraction components on the separating roller, the normal working condition of the separating roller and the moving velocity formula of peanut pod on the separating roller are obtained.

Through field test, the sieve-roll combined peanut pod cleaning device is applied to the pick-up peanut combine harvester with good effects of impurity rate ≤2.0% and cleaning loss rate ≤1.5%, which meets the expected design requirements and meets the national industrial standards.

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