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Studies About Variation of Morphological Characters of Pine Stands Canopy from Artificial Origin and their Relationship with Taxation Indexes

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Mass occurrence of natural regeneration or undergrowth appearance on this forest area is primarily depends on presence of semination sources in this part of forest. In condition of tape pine forest in Irtysh there is possible to create sparse trunk (sparse stable) seminiferous pine crops on pyrogenic fields of forest tapes, forest reproduction or forest regeneration by seeding way. Only multiple seed regeneration of forest provides early-maturing, multirowing of natural plantation of the pine forest tapes. As a result regenerated self-sown forest or formed tree stands in different ages.

Key words: Forest seeded plantations, canopy structure, forest stands, yielding seed cultures of pine, pine forest tape.

In accordance to the Committee of Forestry and Hunting data from 1997 to 2010 in Pavlodar and East Kazakhstan regions more than three thousand fires occurred on the area over 140 thousand hectares and more than 130 thousand hectares of forest were burned. Overall area for forestry reforestation on both reserves is more than 300 thousand hectares. And annual volumes of planted forests in the pine forest tape at this time are only 4172 hectares per year[1].

Pine on the forest tapes is formed on the whole pure and less mixed plantations. There is a different understanding of the basic concepts of forest resumption in science and industry. In some cases, under the natural forest regeneration is understood the process of spontaneously occurring in the forest, though subordinated to the definite laws of growth and development in ontogenesis as all natural processes. In other cases - as a process managed by the forester, as a method of natural forest reproduction.

Process of forest reconstruction with all its characteristically significant properties provided by anlage and keeping of forest-seed plantation on fire-sites and wastelands where tree stand is forming from seeds of natural origin tree species.

Therefore the study of development regularities of natural forest regeneration process which should be used during afforestation of pyrogenic areas of pine forest tape in Irtysh has the great theoretical and practical importance.

90% of tape pine forest in Irtysh dominated natural seeded origin plantation. Consequently all tape pine forests in Irtysh are self-sown forest where appear main biological regulations of becoming and seeded origin pine tree-stand formation in natural condition.

Under certain conditions occurs quite satisfactory natural regeneration in the pine forest

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tapes. L.I. Gribanov[1] predicated that the main significance in the process of natural regeneration has tentative resumption arising under the forest stands canopy of the older tree generation. Artificial reforestation in pine forests tapes seeks long ago. Peculiarities of natural regeneration in southern regions the pine forest tapes of Irtysh, namely woodland in present territory of GFNR (Government Forest Natural Reserve) "Semey ormany" and "Yertys ormany" was studied in 1946-1947 in detail. The dependence of the weight of the needles on its age and the number of plants in bio group was given in K. Igembaeva's work.(1995) [3] Researcher was able to describe this dependence by regression equation y = f (x). On the basis of research material the author came to the conclusion that the conditions for tape pine forests in Irtyshe, the optimal needles number corresponding to hydrological conditions and transpiration expense should be between 8-9 tons (fresh state) per 1 ha.

Numerous calculation data of natural pine regeneration allow in past to conclude about satisfactory resumption despite of hard soil-climatic conditions, frequent forest fires and low level of forest management. Pine in the tape forests forms a substantially pure and mixed stands less planting, and 90% of them have natural origin. Natural pine forests are formed by influencing of many factors. Firstly, the pine in condition of forest tapes bear fruiting annually, so the shoots and undergrowth distributed by age relatively evenly. Mass occurrence of natural regeneration connected with seed years here were observed rarely. Undergrowth appearing depends not only on seed availability, also on degree of topsoil hydration.

Secondly, for the formation of pine plantations affect wildfires. In the past, they cover huge areas. According to L. Gribanov (1960) [1,2], in pine forest tapes it is almost impossible to meet the forest areas that would not have traces of forest fires.

Thirdly, most of the plantations, especially in the pre-revolutionary period, were passed by selective cutting to find "mine" with a sample of the best trees. Under the influence of described factors were formed pinetums of forest tapes.

Resumption of fire-sites depends on availability of disseminators and on period of seeds bloom. If just after fire there is a good seed crop, so resumption of fire-sites is provided. Fire-sites which is not disseminating for the second year after occurrence overgrown grasses (especially cereal), then their resumption delayed for a long time. Even burnt dissemination during overgrowing by cereal grasses doesn't provide successful resumption.

According to N. Egorov (1934) [4], pine in forest tapes is fruiting annually. Crop-failure years practically not observed. He found that on plantation with III class age, the average number of pine seeds is 3.2 kg per hectare. This number of seeds provides the process of natural pine regeneration.

Figure 1 shows continuous growth of resumption number from dry pine forest type of high hillock to field land forest and sharp dropping on lowland forest type. Increasing of resumption number explained, mainly, by gradually increasing of soil moisture on the first four forest types. Reducing the resumption number on the lowland pine forest type, where the terms of soil moisturizing in comparison with other types of forest are the best, is explained by increase of coverage the soil grass.

General provision for all types of forests is presence of the basic mass of pine resumption under the canopy of pine stands completeness from 0.4 to 0.6 in the projection of tree crowns or in the cone of shadow generated by them. These shadow cones are created on northern and western sides of trees, shrubs or massive afforestation.

Usually undergrowth located groups in the north or north-west cones of trees. On open spaces undergrowth are met seldom. Renewal on the sites where took place the fires is unsatisfactory.

Table 1 shows that the recovery processes are slow on fire-sites. Often these processes linger for ten years. The reason is a small amount of atmospheric precipitation, not exceeding 200-250 mm per year and lack of experimental work to reforestation cutting out of fire-sites and burned forests on a strict scientific basis.

MATERIALS AND METHODS

Foresters in the early years have

observed that the nature during regeneration of non-forested areas populate them very densely. However, as a grow process density decreases rapidly. Thus it is most quickly reduced in a so-called stage of thicket and pole, in stage of crown-cover formation and most rapid growth of trees in diameter.

At various tree species and in different types of growth place conditions this stage comes at different age, for example, for pine plantation – in 20-30 years.

We determined the number of trees by development of crown, taking as normal ratio of crowns' diameter (D_c) to the height of the trunk (H_{tree}) as $D_c / H_{tree} = 1/5$. In this connection supply area of one tree is equal to the square with a side equal to 1/5 of the height of trees. Then the number of trees (N) per 1 ha is determined by formula (1):

$$N = \frac{10000}{(H/5)^2} = \frac{25000}{H^2}; \quad ...(1)$$

where: H – tree height, m

Based on the proportional relationship between the crown diameter and trunk diameter at a height of 1.3 m, the number of trees determined by the formula (2):

$$N = \frac{10\ 000}{0{,}866K^2} \quad ...(2)$$

where K – the crown diameter, m.

To express the relationship between the pine crown diameter (D_C) and pine trunk diameter (d_{CT}) was offered the formula (3):

$$DC = 10\, d_{CT} + 100 \quad ...(3)$$

It reflects the specified regularity in plantings with different density and in different conditions of their growth place. It follows that the most favorable planting density can be set only on basis of crowns size that has the best growth and high productivity.

During natural thinning process in cultures with different density the start of tree mortality, and its intensity determine by degree of canopy cover and features of tree placement on areas. The condition of growth place is better and cultures are denser, so the earlier and more intensive natural mortality.

In rare tree cultures competing influence of trees appear later than in density cultures.

In formation phase when the shoots, undergrowth or seedlings in the beginning of their ontogenetic development form the crown, predominates intense intraspecific competition. In this period, any rapprochement of individuals causes intense depression each other.

It was found that there is a certain limit of crowns convergence in nature, where trees are already feeling the negative impact each other and foresters called this phenomenon board of critical crown convergence.

It depends on height of the tree, and express by the equation (4)

$$y = 73.249 - \frac{24.769}{x} \quad ...(4)$$

where: y - the critical distance between the trees, cm

x - tree height, m (0.5-5)

To establish a correlation connection between age of cultures, tree culture diameters and crown diameters detected small dependence and solved by equations of following form:

1. Scheme for planting culture 0,7 x 0, 7 m:

$$\lg D^1_c = 0.535\ \lg A + 0.6711\ \lg d_{1.3} + 1.1429;\ R_{1=0.998} \quad (5)$$

2. Scheme for planting culture 1,5x0,7 m:

$$\lg D^2_c = 0.967\ \lg A + 1.9086\ \lg d_{1.3} + 0.647;\ R_{2=0.969} \quad (6)$$

3. Scheme for planting culture 1,5x1,5 m:

$$\lg D^3_c = 2.2189\ \lg A - 1.4396\ \lg d_{1.3} + 1.069;\ R_{3=0.997} \quad (7)$$

where,

lg – tree crown diameter, cm;

lg A - age of cultures, years;

lg $d_{1,3}$ - tree diameter at breast height, cm;

R - the multiple correlation coefficient.

For determine the variability of tree crown diameter depending on the age of planting and tree diameter at breast height, except for the standard deviation mean square , calculated relative variability of this character, that is the coefficient of variation $_v$, and the average error coefficient of variation $\pm m_v$.

In the scientific literature widely covered issues of trees differentiation in the forest. Many foresters studied this process in artificial plantations, laying for these purposes forest cultures of varying thickness. Many researches have reported improvement of tree growth on diameter at rare cultures.

Qualitative characteristics of young crops differentiation fully reflects crown diameter or crown width of trees (Dc), which have a close correlation with diameters at breast height of trees $d_{1.3}$.

Increase of regular connection between crown diameters D_c and diameters of trees at $d_{1.3}$ height, has important meaning for research crown size, thickness and height of trees according to the culture density. With increasing density of cultures, reduces the size of conifers and their total weight per one tree. With increasing density reduced crown diameter and length l_c.

For formation of developed symmetrical crowns and stable root systems, it needs adequate living space at early age. Pine cultures with "quadratic" planting schemes at young age have an advantage in growth and development of crown size (Table 2).

In conditions of tape pine forests at Priirtyshi care of soil, as in the coulisse, as in solid pine cultures with placement of seats 1.5 x 0.7 m normally stop on the fifth year, and cultures converted into the forested area in the autumn. From the data of Table 2 are shown the thickening period in the rows comes at age 9 years of cultures, and complete thickening between rows comes only in 15 years.

In this regard, the first tree-felling should be performed at the age of 16-20 years. Only the oppressed and strongly lagging in growth trees are subject to cleaning.

A long time in artificial reforestation in choosing density foresters imitate nature and created at the beginning very dense culture. However, in the 60-ies of the XIX century it was noticed that the dense planting unprofitable, as they give small forest and decreased timber reserves.

RESULTS AND DISCUSSION

According to our research it was found that effective natural seed regeneration occurs on cones of elder generation trees' shadow, in the seed dispersion area from sources of sawing. In this zone formed normal pine plantations of seminal origin, in the presence of pine undergrowth on the strip with 35 m width, on the northern fringes of the forest - 764 pcs / ha, and on the southern edge on strip with 25 m width - 904 pcs / ha and on the eastern and western fringes on strip with 35 m width - 876 pcs / ha and 884 pcs / ha accordingly.

The most favorable planting density can be set only on the basis of crowns sizes that have the best growth and performance[5].

V. Nesterov (1954)[6] has made a judgment about degree of crown development by the ratio to the crown length (Lc) and stem height (H): for the pine the normal coefficient is about $L_c / H = 1.3$. Nesterov stresses that in plantations optimum number of trees per hectare varies with the age, corresponding to the different conditions of growth place. In accordance with this change thinning degree of trees in time, improve their growth on height and diameter, and other taxation indexes of crown tree development.

With age, there is a change in the relationship nature of cultures between the individuals within a species.

On fire-sites created seeding, sparse trunk pine forest plantations as a sawing source of adjacent areas, with a limited number of seats per hectare. Number of planting place - 760 - 900 pcs / ha, when as seed materials using undergrowth with closed root system.

Undergrowth – is young generation of woody plants capable to formation a new tree stand. Undergrowth include younger generation of woody plants with age over 2 - 3 years old.

The number of trees N, per hectare, depending on the crown diameter C is determined by the formula (8):

$$N = \frac{10\,000}{0{,}866C^2} \quad ...(8);$$

and the number of trees65tgb wej33s2 planted on the silvicultural area ranges from 760 to 900 units / ha (9).

$$\text{hence } C^2 = \frac{10\,000}{0{,}866C^2} \text{ OR } C = \sqrt{\frac{10000}{0{,}866N}} \quad ...(9);$$

where C - crown diameter in meters, the desired value and development.

The data in Table 3 also show that there is a possibility of creating a sparse (sparse stable) sowing seeds of pine at young age; applying a square diagram of planting 3.92x3,92 to 3,16x3,16

Table 1. Number of undergrowth on fire-sites (in thousand pieces. per ha)

S. No	Forest types	Pine	Birch	Aspen	Total
1	Dry pine forest of high hillocks	0,2	-	-	0,2
2	Dry pine forest of gently sloping hill	0,4	Unit	0,2	0,6
3	Sink forest (fresh forest)	0,7	0,1	0,3	1,1
4	Lowland forest (grass forest)	0,5	0,4	1,0	1,9

Table 2. Dynamics of Pinus sylvestris crowns development on pine-forest soils on method of planting the forest cultures

Age, years	Cultures, with the line scheme of planting 1,5×0,7m			Square planting scheme 1,5×1,5 m			Square planting scheme 0,7×0,7 m		
	h – height, cm	$d_{1,3}$ – stem, cm	Dc, cm	h – height, cm	$d_{1,3}$ – stem, cm	Dc, cm	h – height, cm	$d_{1,3}$ – stem, cm	Dc, cm
6	1,52	3,54	59	1,60	3,53	101	1,56	3,53	84
9	2,13	4,90	114	2,60	5,70	141	2,36	4,90	116
14	4,13	5,52	152	4,72	7,0	240	4,30	5,52	175

Table 3. Number of trees and their crown diameter

N – number of trees, plants / ha	650	750	850	900	1000
C – crown diameter, m	4.20	3.92	3.68	3.58	3.40
feeding area, m^2	15.4	13.3	11.7	11.1	10.0
Index or density planting scheme	3.92	3.65	3.42	3.33	3.16

Table 5. Correlation connection between taxation rates: $d_{1.3}$and N the number of plants of stands age

Age of trees, years	15	20	30	40	50	60	70	80
Diameter at breast height of trees, d1,3 cm	5,3	6,6	9,3	11,9	14,3	16,2	18,3	19,9
Number of plants, N pcs / ha	3450	2160	1530	1250	998	880	730	640

Table 6. The growth in height and diameter variation of trees based on pine forests age

Age of trees, years	Growth in height, m	Growth in diameter, cm	Varying the number of trees, depending on the age of plants / ha	h/d
15	3,9	5,3	3450	0,74
20	5,3	6,6	2160	0,80
30	10,9	9,3	1530	1,17
40	12,0	11,9	1250	1,01
50	16,0	14,3	998	1,12
60	17,6	16,2	880	1,09
70	18,3	18,3	730	1,00
80	18,9	19,9	640	0,95

Table 7. Dynamics forest indices size of tree crowns depending on the age of pine plantations

Age of pine forests, years	10	30	50	70	80
The diameter of the tree crown, Dc, m	1,1	1,6	2,2	2,7	3,2
Crown length 1c, m	2,1	3,9	5,4	6,8	8,0

Table 8. Dynamics of forest indices of pine crowns in size depending on their age

Age of trees, years	15	30	50	70	80
Ratio of the height and diameter of trees, H/D	0,82	0,91	1,04	1,03	1,15
L_c – crown length, m	2,1	3,9	5,4	6,8	8,0
Dc - crown diameter, m	0,9	1,6	2,2	2,7	3,2

Table 9. Diameter dependence on the age of the trees and plants on the volume of the tree crown

Age of trees, years	75	60	55	43	41
The diameter of the tree crown, m	6,4	5,6	5,2	4,4	4,3
The volume of the tree crown, m^3	130	100	70	50	50

m^2. Rare cultures have a stronger crown and their average height and diameter are higher than the thick culture of the same age.

Much attention paid to planting density in growing crops. Worked out offers for establish forest plantations with optimal density for the age 9-15 year old. However, at the age of higher producing of plantation from 30 to 80 years, optimum amount of trunks per unit area still remains unknown after passing the tree stand self-thinning and natural stage of their fall off. In young cultures trees distributed evenly on silvicultural area and they have the same age, and therefore under the same conditions until complete closure of woodland canopy. In condition of tape pine forests the natural pruning is very slow and does not provide with feeding area enough for the normal development of trunk. And so, the regulation of stand density is mighty tool on the hands of foresters during formation of wood community. G. Eytigen (1918) wrote that the optimum density of forest plantations can be established only on basis of crown size of trees, which have the best growth and good leaf mass [5].

Research of several authors [8,9] show that the main characteristic indicators of planting canopy (crown diameter, crown length, crown volume) are in regulatory connection with biometrical patterns of forest stands and particular with a trunk diameter at breast height $d_{1.3}$.

Consequently, the density and number of plants, amount of leaf mass of even-aged and conditionally even-aged pines are the function of planting age.

With increasing the planting age, the number of trees reduces as a result of self-thinning, and together with this process the amount of leaf mass changes.

Intensive self-thinning of stand occurs between 20-40 years old. If in dense, 12-year-old-pine forest stand were more than 10-14 thousand trees, the in 30-40 – years-old pine forest left only 2000 - 2500, at 60 years old – 950, 80 years old - only 650 trees per hectare.

Sharp increasing the amount of leaf mass were in saplings at the period of pole, at the pine with age 30-40 years old. With the further development of forest stands and their transition to the age of maturity stage the amount of the leaf mass reduce, associated with a sharp differentiation and death of a large number of trees. With increasing age of the stand and the transition to in the age phase of aging dramatically decreases the amount of leaf mass. Thus, changes in leaf mass with age of trees have a certain regularity character.

We need to solve some practical problems of silvicultural production for study the character of leaf mass change depends on age of stand.

Adjusting the degree of development of leaf biomass by felling, proper placement of trees

and displacement of various species, also relating the conditions for a natural accumulation of soil moisture can be avoided so-called critical period in the life of the trees cultures, and to create sustainable and durable artificial plantations.

Scotch pine has a wide range of edaphically diapason. It can be cultivated on various zonal chestnut type soils - sandy, loamy mechanical structure, including areas with rocky layers, as well as root accessible groundwater.

When creating pine plantation in condition of limited amount of atmospheric precipitations (average annual rainfall is 230-240 mm, the minimum 150 mm) in the areas of pine tape forest of Irtysh forced to strictly regulate their density and structure of the stand canopy to limit transpiration costs.

Pine forests in the tape forest have a specific feature of the growth. It is characterized by low closeness of stands, which leads to the formation of tapering trunks form. In the pine forests trees placed over the phytocenosis area irregularly, but as a clump and there is a significant density. Besides pine tape forest characterized by a complex structure, uneven-aged, multi-tiered canopy. Therefore closeness tree canopy is speed and lower tiers complement the fullness of the upper canopy. Canopy stands represents a set of tree crowns, which in the closed position, influencing each other, create a certain environment within which occur various biological processes and phenomena. Environment in turn, affects them, and on the formation of stands canopy. Therefore, the study of trees canopy structure must be justified on the knowledge of regularity and relationships between taxation rates with growing inventory indices canopy part of the stand. Comprehensive study of all forest indices stands, including canopy, can more fully characterize the natural forest environment objects as the statics and dynamics.

Practical interest is the calculation of the absolute value of the ratio of the mean diameters of the crown to the average diameter D_c pine stands $d_{1.3}$.

Therefore the study of the regular connection between the diameters of tree crowns and Dc diameters of trees at breast height has practical importance (Table 4).

Correlation connection between overage the values of D_c and $d_{1,3}$ depending on the age of pine planting very high: $R = 0{,}994 \pm 0{,}003$ and this dependence of the studied parameters we expressed by the following equation (10):

$$\lg d_{1.3} = 0.5218 \lg A + 0.6146 \lg D_c - 0.0671; \ldots (10)$$

However, to obtain more objective indicators of this canopy forest (D_c - crown diameter, L_c - crown length, V_c - crown volume), it is necessary to identify the relationship between taxation rates of the stand to vary with age stands. Features of influence of age structure and ontogenesis developmental stages of stands on inventory indices stands characterized by the data in Table 5.

The data in Table 5 shows that with increasing age stands of pine plantations increases the diameter of the tree stand at breast height $d_{1.3}$, and opposite with increasing stand age decreases the amount of plant N units / ha. On the character of the change $d_{1.3}$ and N, influence growing conditions, age of trees and the ontogenesis developmental of stands. With increasing stand age increasing the diameter of the trees, it is 6a fact proved by many scientists research (Belov1983, Nesterov 1954) [7,8].

However, research on the variation of morphological traits canopy plants and their relationship with valuation index stands are not available in the region. Therefore, we conducted a study of the issues raised in relation to the pine forests of artificial origin (Table 6).

Materials for the research was provided by data of 30 test area at the Irtysh Forest Experimental Station in 1975-1980 yy period. Test areas were laid in the pure pine plantations which established in 1917-1937 gg. at Semipalatinsk and Pavlodar Oblast and Altai Region. The magnitude of the test area was set depending on the age and condition of the crop, but it was a prerequisite to the existence of the test area no less than 150-200 pine copies.

On each test area, depending on the specific conditions were laid soil profiles to determine the species of sandy soil. In the 10-20-30-year-age cultures re-count made by one and two centimeter of thickness at breast height of trees with the division into classes of growth. As the formation of pine trees begin division by class of growth, the plantation was allocated only three classes (groups) and individual deadwood on the

root. Trees that create the main canopy of artificial plantations (I - III), were joined into one group. These include the highest and largest specimens of pine with a well-developed crown.

In class IV included lag in growth somewhat weak pine trees with underdeveloped crowns, but with peaks open to direct sunlight. Trees in this class occupy the most precarious situation in the plantation. They may change with age and environmental conditions as the main exit canopy stands, and on the contrary, to wither away.

V classes include the smallest, severely stunted, with compression of the crowns, dying, but still viable trees. Trees in this class are under canopy areas and didn't receive direct solar radiation.

All forest inventory measurements (height, diameter, height increment and diameter, also the selection of sample trees, etc.) are produced only by growth classes.

Modeling pine trees were selected according to diameter of not less than 3 copies per step thickness.

In 10-12-years-old pine plantations were studied closing crops. To characterize the development of crowns in a row and between rows, determining their horizontal projections of the trees measured radius to the cardinal for the most developed leaves.

To study the dynamics of the crowns measured BL crown diameter of all test trees along and across the rows. Diameters at breast height $d_{1.3}$ were measured in two mutually perpendicular directions to the nearest 1 cm LK - CZK length or depth measured from the crown of the first living whorls until tops of trunks.

Age of trees was determined by felled trees in three models for each age class.

The results of measurements were used for calculating the volume of tree crowns on the second-order equation of the paraboloid (12):

$$V = \frac{1}{2}\eta R^2 x l_{dc} \quad ...(12)$$

where,

R - average radius crowns, m

ldc - the length or depth of crowns, m

Links between the studied $d_{1,3}$ and l_{dc} trees in forest stands generations in different age stages of development carried out by correlation regression equations such as (13):

$$y=a_0 x a^x_1 \quad ...(13)$$

Therefore, the empirical formula should look for similar to the following (14):

$$y=ax^2+bx+c \quad ...(14)$$

This equation of the parabola of the second order - it expresses the parabolic dependence when there is a rapid increase or decrease of one value (y) for a uniform increase in the other (x). Parabola of the second order - the curve with one possible maximum or minimum.

Connection between $h/d_{1.3}$ and ldc trees in stands of all ages and types of structures is carried out according to the equation of the line [10] as we can see from the table 7.

Correlation connection between taxation rates sizes treetops very high R = 0,9997 ± 0,002 and it is dependence on the studied parameters expressed by the following regression equation (15):

$$lgl_c = 0.4274\ lgA + 0.3754\ lgD_c - 0.1186 \quad ...(15)$$

where,

lg L_c - crown length, measured along the length of the stretch of the first branches of the crown to its top of the trunk, m

lg A - pine age, years

lg D_c - crown diameter, m

R - Coefficient of multiple correlations.

The table 8 shows that with increasing stand age crown diameters () increases crown length () which described by following formula.

Correlation between taxation rates sized crown is very high: R=0.9173±0.0475and this dependence of the studied parameters is expressed by the following regression equation (16):

$$lg(H/D) = 4.4718\ lgDc - 3.9892\ lgL_c + 1.4052 \quad ...(16)$$

where,

lg (H/D) - a ratio of height and diameter of the trees;

lg D_c - crown diameter, m;

lg L_c - crown length, m

Installed between these inventory indices stands canopy coupling is described by the equation (17):

$$lgD_c = 0.4307\ lgA + 0.1454\ lgVc - 0.3099 \quad ...(17);$$

where,

lg D_c - diameter of the tree crown, m;

In lg A - age pine plantations, years;

lg V_c - single tree volume, m^3

R - the multiple correlation coefficient.

Temporary test area lay in the pure pine

plantations with different completeness, aged 41 to 75 years old in flat boron forest type (Table 9).

Analysis and statistical processing of the experimental data revealed regularity changes in indicators of crowns sizes (Table 2-9). The main determining factor of all taxation indexes of forest stand and their crown size is plantings age. With increasing stands' age changes growth motion of pine plantations on height and diameter and the number of plants.

At a young age there is intense movement of trees by diameter. This is especially characteristic for small stages thickness where dominated oppressed trees that have underdeveloped crowns, respectively, and their small size. About at 60-70 years old formation of stands canopy basically ends [10].

CONCLUSIONS

According to our research, in terms of Irtysh pine forest tape formation of stand canopy begins at age 50 and lasts up to 80 years.The number of plants decreases from 998 units / ha to 640 units / ha gradually with increasing stand age. By 80 years Irtysh pines with 80 years old and more number of plants less than 640 pcst/ha and then occurs canopy stand degradation, due to the differentiation of trees on growth classes. Pine in the pine forest tapes is self-sowing of natural origin. Mass occurrence of natural regeneration or appearance of regrowth on this forest area is primarily depending on the availability of insemination sources in this part of the forest. At the same time the formation of uneven-aged planting is due to multiple natural colonization of this part of the forest by testicles. As a result, reproduced self-sown forest or formed stands with different ages. Uneven-aged plantations are characterized by stair-step closeness of canopy. Most of these plantations are two-tiered, three-tiered less frequently. On the area the trees are located as clumps. The spatial structure of plants depends on the type of forest.

For example, in the dry pine forest type of gentle hillocks (D_{FH}), uneven-aged plantations consist of three generations. The first generations of trees are 121 - 160 years old. The upper canopy stands include trees of the first generation. The second generation consists of 81 - 120 years old trees. Most of trees from the second generation located in the upper canopy. The third generation forms from the trees at age over 80 years. The third generation located as clumps around the trees of the first and second generations and in midday shade cones of parent canopy.

Using data, Irtysh foresters, in conditions of pine tape forest could create rare trunks (sparse) of seeding pine cultures on pyrogenic squares of tape forests, forest reproduction or forest regeneration in seed way. Only multiple seed regeneration of forest provides uneven-aging, multilayering of natural plantations in tape forests. Being a single level, even-aged pine plantations by planting have horizontal closeness. Trees distributed on the area relatively evenly. Currently close planting culture in the region are still thick and solid that do not meet the basic requirements of natural seed regeneration of forest.

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